POLICE MODIFIER GUIDE

WHAT'S NEW

What's New

Model/Series/Availability
- *1 – Pursuit Rated Super Crew (150 A)

Packages
- *Note: Bedliners both drop-in and spray-in are not available on F-150 Police Responder

Functional Equipment – Super Crew only
- Super Crew (145") wheelbase [2,030 lbs Max Payload, 7,050 lbs GVWR], 3.5L V6 EcoBoost, 4 x 4 Drivetrain
- 18" Steel Wheel Standard, 18" Sliver Aluminum - optional

For more information on Features and Options, refer to the Brochure:
https://www.ford.com/police-vehicles/f150-police-truck/

POLICE MODIFIER GUIDE

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POLICE MODIFIER GUIDE

SECTION 1 – INTRODUCTION

INTRODUCTION

Ford Motor Company has assembled this Modifier Guide to assist vehicle modifiers in producing safe and quality products. Ford believes that safety and quality come first. To achieve customer satisfaction, we want to assist modifiers in achieving the highest standards of safety and quality in their products.

This book is divided into topics pertinent to modifiers of police vehicles. Reference is made to the current Workshop Manual for appropriate service procedures, torque specifications, component separation clearances and other standard information which is common with the unmodified vehicle. Specifications which are unique to the guide are designated.

This modifier guide is not a "how-to" book; it should be used as a checklist to help make sure that certain important steps in the modification process are considered. While Ford is providing this information to assist modifiers, it does not warrant the products, methods, materials or the workmanship of the modifier. Nor does it warrant against failures that result from the modification of a vehicle.

Following the guidelines contained in this guide it does not assure individual modifiers that the products they modify comply with U.S. Federal or Canadian Motor Vehicle Safety Standards in effect at the time of the modification. The guidelines set forth are based on engineering analyses of typical police vehicles. If followed, the modifier's efforts in certifying vehicles to applicable standards should be aided. Compliance testing that may be required for certification of specific vehicle configurations or construction is, however, the sole responsibility of the individual modifier.

The only F-150 model suitable for use in police service is the pursuit-rated Police Responder.

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GENUINE FORD ACCESSORIES FOR YOUR VEHICLE

A wide selection of genuine Ford accessories are available for your vehicle through your local authorized Ford or Ford of Canada dealer.
These quality accessories have been specifically engineered to fulfill your automotive needs; they are custom designed to complement the style and aerodynamic appearance of your vehicle. In addition, each accessory is made from high-quality materials that meet or exceed Ford's rigorous engineering and safety specifications. Ford Motor Company will repair or replace any properly installed genuine Ford accessory found to be defective in factory-supplied materials or workmanship during the warranty period, as well as any component damaged by the defective accessory. The accessory will be warranted for whichever provides you the greatest benefit:

- 12 months or 20,000 km (12,000 mi), whichever occurs first; or
- the remainder of your new vehicle limited warranty.

This means that genuine Ford accessories purchased along with your new vehicle and installed by the dealer are covered for the full length of your new vehicle's limited warranty — 3 years or 60,000 km (36,000 mi), whichever occurs first. Contact your dealer for details and a copy of the warranty.

CONSIDERATIONS WHEN USING OR INSTALLING ACCESSORIES

For maximum vehicle performance, keep the following information in mind when adding accessories or equipment to your vehicle:

- When adding accessories, equipment, passengers and/or luggage to your vehicle, do not exceed the gross vehicle weight rating (GVWR) or gross axle weight rating (GAWR) as indicated on the Safety Compliance Certification Label. Consult your dealer for specific weight information.
- The Federal Communications Commission (FCC) and Canadian Radio Telecommunications Commission (CRTC) regulates the use of mobile communication systems, such as 2-way radios, telephones and theft alarms that are equipped with radio transmitters. Any such equipment installed in your vehicle should comply with FCC or CRTC regulations and should only be installed by a qualified service technician.
- Mobile communication systems may harm the operation of your vehicle, particularly if they are not properly designed for automotive use.
- To avoid interference with other vehicle functions, such as the anti-lock brake system (ABS), amateur radio users who install radios and antennas onto their vehicle should not locate the antenna in the area of the driver's side hood.
- Electrical or electronic accessories or components that are added to the vehicle by the dealer or the owner may adversely affect battery performance and durability.

For further technical questions, please contact the Ford Body Builders Advisory Service at the following link: https://www.fordpro.com/en-us/upfit/bbas/ and submit a request.

POLICE MODIFIER GUIDE

SECTION 1 – GENERAL INFORMATION

IMPORTANT SAFETY NOTICE

NOTE: The descriptions and specifications contained in this guide were in effect at the time this guide was approved for printing. Ford Motor Company reserves the right to discontinue models at any time or change specifications or design without notice and without incurring obligation.

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This guide provides general direction and guidelines for performing modifications to the vehicle, which will help assure reliability.

There are numerous variations in procedures, techniques, tools and parts for modifying vehicles, as well as in the skill level of the individual doing the work. This guide cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this guide must first establish that they compromise neither their personal safety nor the vehicle integrity by the choice of methods, tools or parts.

WARNINGS, NOTICES and NOTES

As you read through this guide, you will come across WARNINGS, NOTICES and NOTES. Each one is there for a specific purpose.

- WARNINGS remind you to be especially careful in those areas where carelessness can cause your personal injury.
- NOTICES are given to prevent you from making an error that could damage the vehicle or the vehicle's components.
- NOTES give you added information that will help you to complete a particular procedure. The following list contains some generalized warnings that you should follow when working on a vehicle.

WARNING:

- For eye protection, always wear safety glasses.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Make sure the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. The gear selector should be set in PARK unless instructed otherwise for a specific operation. Place wood blocks (4-inch x 4 inch or larger) against the front and rear surfaces of the tires to help prevent the vehicle from moving.
- Do not smoke while working on a vehicle.
- To reduce the risk of injury, always remove rings, watches, loose hanging jewelry and loose clothing before working on a vehicle.
- When it is necessary to work under the hood, keep hands and other objects clear of the cooling fan blades.
- Failure to follow these instructions may result in personal injury or death.

NOTICE:

- Do not modify the cooling system. High voltage vehicle components may be damaged if any cooling system modifications are attempted.
- Before placing the vehicle in a paint booth, make sure that the HVTB is not installed in the vehicle. In addition, the Charge Port Light Ring (CPLR) must be covered / protected from heat. High paint booth temperatures may damage the HVTB and the CPLR.
- Remove the service disconnects while carrying out any vehicle modifications.

Making Safety Devices and Elements Inoperative

The vehicle contains many safety features required by US Federal or Canadian Motor Vehicle Safety Standards. These features, which include the key-on-ignition chime and brake lights, should never be disabled or modified.

CFR 49 Section 30122 states that "A manufacturer, distributor, dealer or motor vehicle repair business may not knowingly make inoperative any part of a device or element of design installed on or in a motor vehicle or motor vehicle's equipment in compliance with an applicable motor vehicle safety standard prescribed under this chapter unless the manufacturer, distributor, dealer or repair business reasonably believes the vehicle or equipment will not be used (except for testing or a similar purpose during maintenance or repair) when the device or element is inoperative."

GOOD PRACTICES

Process and Quality Assurance Systems
A formalized Process and Quality Assurance Systems check may be helpful in consistently producing high-quality products. An overview of some of the key items for such a system are outlined in this section.

Quality Assurance
Completed Unit Sign-Off: All control items should be inspected with a written sign-off. All labels should be inspected and signed off, including verification the information on the labels is correct. All appropriate systems should be checked for leaks. A road test should be performed to verify that all systems are operating correctly. All systems and functions that were provided by Ford should be checked to make sure they function correctly after the build process.

The modifier's Process and Quality Assurance Systems should also assure that appropriate training is provided to the employees.

Minimum and Maximum Screw Sizes
When installing aftermarket equipment, avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system and suspension.

POLICE MODIFIER GUIDE

SECTION 1 – GENERAL INFORMATION

NEW VEHICLE STORAGE

New Vehicle Storage — General

- Vehicle should be stored in a dry, ventilated place, and protected from sunlight, if possible.
- If vehicle is stored outside, maintenance against rust and damage, as described below, is recommended.

NOTICE: Keep all rubber parts free from oil and solvents.

New Vehicle Storage — Body

- Wash vehicle thoroughly to remove dirt, grease, oil, tar or mud from exterior surfaces and underside of front fender.
- Periodically wash if vehicle is stored in exposed locations.
- Touch up exposed raw or primed metal to provide rust protection.
- Cover chrome and stainless-steel parts with a thick coat of auto wax to prevent discoloration. Rewax as necessary when the vehicle is washed.
- Lubricate all hood, door hinges and latches with a light grade oil.
- Cover the interior soft trim to prevent fading.

New Vehicle Storage — Engine

- Start the engine every 15 days. Run it at fast idle until it reaches normal operating temperature.
- With foot on brake pedal (and brake applied), shift the transmission into all gears while the engine is running.

New Vehicle Storage — Fuel System

Regularly move vehicle short distances to mix fuel anti-oxidation agents.

NOTE: During extended periods of vehicle storage (60 days or more), gasoline may deteriorate due to oxidation. This can damage rubber and other polymers in the fuel system and may clog small orifices. A commercially available gasoline fuel stabilizer (Sta-Bil or equivalent) should be added to gasoline-powered vehicles whenever actual or expected storage periods exceed 60 days. The manufacturer's instructions packaged with the product should be followed. The vehicle should then be operated at an idle speed to circulate the additive throughout the fuel system.

New Vehicle Storage — Tires

Most high-performance tires are made with nylon overlay.

As such, the following steps should be taken to avoid flat spotting when the vehicle is not used for a period of time.

- Keep the vehicles tire pressure at the recommended operating pressure.
- If the vehicle is stored for a period longer than 15 days, it should be moved several feet during each 15-day period. The vehicle should be parked after being moved so that a different portion of the tread contacts the ground.

TIRES AND LOADING

Tire Replacement Requirements

WARNING: Only use replacement tires and wheels that are the same size and type (such as P-metric versus LT-metric or all-season versus all- terrain) as those originally provided by Ford. Use of any tire or wheel not recommended by Ford can affect the safety and performance of your vehicle, which could result in an increased risk of the loss of vehicle control, vehicle rollover, personal injury or death. Additionally, the use of non-recommended tires and wheels could cause steering or suspension failure. If you have questions regarding tire replacement, see an authorized Ford or Lincoln dealer.

NOTICE: Do not install an off road, aggressive tread or incorrectly sized tire. Any of these may cause elevated stress to the steering system. This can cause the power steering system to overheat and shut off the power assist, which can affect the safety and performance of your vehicle.

NOTE: Vehicles are equipped with a reduced rolling resistance tire design. The use of a different tire can affect the travel distance of the vehicle as well as the vehicle's fuel economy.

Make sure all tires and wheels on the vehicle are of the same size, type, tread design, brand, load-carrying capacity and speed rating because it can affect the safety and performance of your vehicle, which could result in an increased risk of loss of vehicle control.

Tire Pressure Monitoring System (TPMS) Principles of Operation

The TPMS monitors the tire pressure using 4 valve stem mounted TPMS sensors to provide accurate tire pressures. Each individual sensor contains its own battery and transmits tire pressure data to the controlling module every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPM module is a radio receiver that collects the tire pressure data and relays the information via the MS-CAN to the BCM. All of the TPMS functions are controlled by the BCM. The TPMS sensors are trained to the BCM, which records each TPMS sensors unique identifier. The BCM records where each TPMS sensor is located based on the training order and compares the actual tire pressure with the desired tire pressure as indicated on the Vehicle Certification label. If the tire pressure deviates from the desired tire pressure the BCM, using the HS-CAN, signals the IPC to illuminate the TPMS warning indicator and also displays a message on the message center. The programmed tire pressure cannot be changed.

This vehicle, as delivered by Ford Motor Company, conforms to Standard FMVSS138, Tire Pressure Monitoring Systems. This system may not function if any of the following components are removed, relocated or modified in anyway:

- Original Equipment Manufacturer (OEM) wheels and tires
- Tire pressure sensors or valve stems
- Body Control Module (BCM)
- Body Control Module (BCM) software and calibrations
- Tire Pressure Module (TPM)

POLICE MODIFIER GUIDE

SECTION 1 – GENERAL INFORMATION

Tire Pressure Monitoring System (TPMS) Principles of Operation (Cont'd)

- Instrument Cluster (IC) module
- Instrument Cluster (IC) software and calibrations
- Vehicle wheelbase longer than originally released.

Certain modification could cause reduced system performance, up to and including the complete loss of TPMS functionality. This may include:

- Non-OEM wheels or tires
- The addition of steel carcass or run-flat tires.
- Modification of the vehicle's recommended tire pressure
- Lengthening of the vehicle's wheelbase may affect signal strength of the sensors to a point where the rear sensors can no longer be heard by the TPM module. (Vehicles certified at released wheelbases only)
- The addition of metallic structures, such as prisoner partitions, may affect the signal strength of the sensors and could interfere or prevent the TPM module from hearing the rear sensors.
- The addition of intended or unintended transmitters to the vehicle may affect the signal strength of the sensors or interfere with the TPM module's antenna.

The TPMS, as delivered from the Ford Motor Company, complies with part 15 of the FCC rules and with RS-210 of Industry Canada. Operation is subject to the following 2 conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

Using Snow Tires and Traction Devices

NOTE: Snow tires must be the same size and grade as originally equipped on your vehicle.

The tires on your vehicle have all-weather tread to provide traction in the rain and snow; however, in some climates, using snow tires or traction devices may be necessary.

Follow these guidelines when using snow tires and traction devices:

- SAE Class "S" cables should ONLY be used on the vehicle front tires.
- Install cables or chains securely, verifying that the cables or chains do not touch any wiring or brake lines.
- Drive cautiously! If you hear the cables or chains rub or bang against the vehicle, stop and retighten them. If this does not work, remove the cables or chains to prevent vehicle damage.
- Avoid overloading your vehicle.
- Remove the cables or chains when they are no longer needed. Do not use cables or chains on dry roads.
- Do not exceed 48 km/h (30 mph) with tire cables or chains on your vehicle.

Consult your dealer for information on other Ford approved methods of traction control.

Vehicle Loading

WARNING: The appropriate loading capacity of your vehicle can be limited either by volume capacity (how much space is available) or by payload capacity (how much weight the vehicle should carry). Once you have reached the maximum payload of your vehicle, do not add more cargo, even if there is space available. Overloading or improperly loading your vehicle can contribute to the loss of vehicle control and vehicle rollover.

WARNING: Exceeding the Safety Compliance Certification Label axle and/or vehicle weight rating limits could result in substandard vehicle handling or performance, engine, transmission and/or structural damage, serious damage to the vehicle, loss of control and personal injury.

Gross vehicle weight rating (GVWR) is the maximum allowable weight of the fully loaded vehicle (including all options, equipment, passengers and cargo). The GVWR is shown on the Safety Compliance Certification Label located on the B-pillar or the edge of the driver's door.

Gross axle weight rating (GAWR) is the maximum allowable weight that can be carried by a single axle (front or rear). These numbers are shown on the Safety Compliance Certification Label located on the B-pillar or the edge of the driver's door. The total load on each axle must never exceed its GAWR.

WARNING: Do not use replacement tires with lower load carrying capacities than the original tires because they may lower the vehicle's gross vehicle weight rating (GVWR) and gross axle weight rating (GAWR) limitations. Replacement tires with a higher limit than the originals do not increase the GVWR and GAWR limitations.

Steps for determining the correct load limit:

- Locate the statement "The combined weight of occupants and cargo should never exceed XXX kg or XXX lb." on your vehicle's placard.
- Determine the combined weight of the driver and passengers that will be riding in your vehicle.
- Subtract the combined weight of the driver and passengers from XXX kg or XXX lb.
- The resulting figure equals the available amount of cargo and luggage load capacity. For example, if the "XXX" amount equals 1,400 lb. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage load capacity is 650 lb. (1400 - 750 (5 x 150) = 650 lb.). In metric units (635 - 340 (5 x 68) = 295 kg).
- Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity calculated in the step above.

Ambient Temperature Change and Tire Pressure

NOTICE: Do not inflate tire higher than maximum pressure stamped on tire sidewall. Premature tire wear or damage to the tire may result.

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the TPMS and activate the TPMS warning lamp.

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified vehicle certification label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70˚F. Max Pressure Adjustment is 7 psi.

Outside Temperature (˚F)	Tire Placard Pressure (PSI)																	
	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21˚C. Max Pressure Adjustment is 50 kPa.

Outside Temperature (˚C)	Tire Placard Pressure (kPa)																	
	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1]When Outside (Ambient) Temperature is greater than 21˚C (70˚F), Inflate tires to placard pressure.
[1]Use the table to adjust tire pressure for P-metric and LT tires only.

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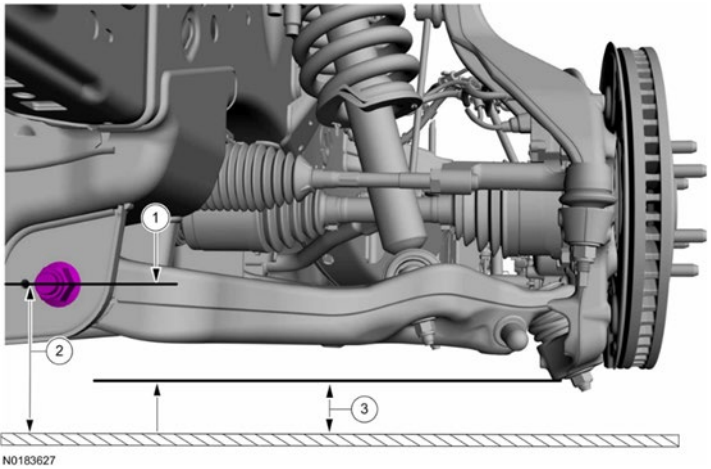
POLICE MODIFIER GUIDE

SECTION 1 – GENERAL INFORMATION

RIDE HEIGHT MEASUREMENT — FRONT



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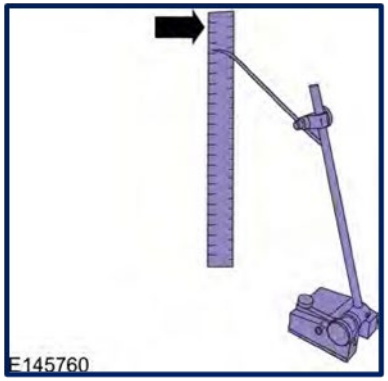

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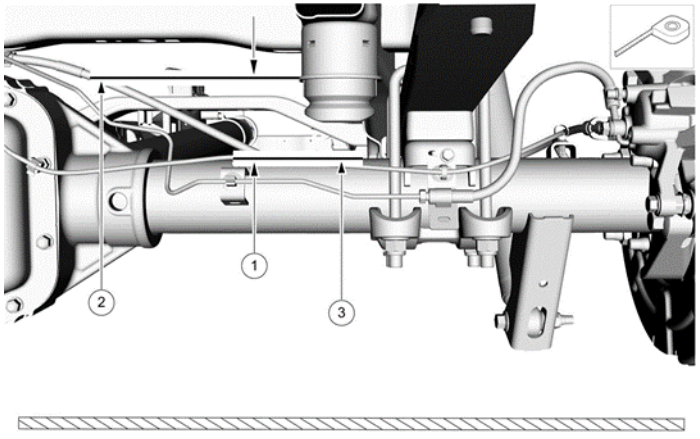
1. NOTE: Make sure that the vehicle is positioned on a flat, level surface. Jounce front and rear suspension vigorously to allow the vehicle to settle.
2. Before measuring ride height check:
   a. Tires are inflated to the correct pressure.
   b. Vehicle should have at least one-half tank of fuel.
   c. All fluids at proper levels.
   d. No cargo inside the cab or bed.
   e. Inspect for aftermarket equipment. Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.).
3. Ride height = 2–3 (Use the General Equipment: Surface Gauge)
   - Measure the distance between the flat level surface and the center of the rear control arm ball joint cap. (measurement 2)
   - Measure the distance between the flat level surface and the center of the rear control arm inboard bolt. (Measurement 3)
4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 2) and (measurement 3).
5. Subtract measurement 2 from measurement 3 to obtain the front ride height.

RIDE HEIGHT MEASUREMENT — REAR



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1. **NOTE: Make sure that the vehicle is positioned on a flat, level surface, transmission in the PARK position and the parking brake OFF.**
2. Jounce front and rear suspension vigorously to allow the vehicle to settle.
   a. Before measuring ride height check:
   b. Tires are inflated to the correct pressure.
   c. Vehicle should have at least one-half tank of fuel.
   d. All fluids at proper levels.
   e. No cargo inside the cab or bed.
   f. Inspect for aftermarket equipment. Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.).
3. Measure the distance between the top of the rear axle tube (Item 3) and the rear axle jounce stop (Item 2) to obtain the rear ride height (Item 1). (Use the General Equipment: Surface Gauge)

RIDE HEIGHT SPECIFICATIONS

Ride Height — Four-Wheel Drive (4WD) Crew Cab — Heavy Duty

ITEM	SPECIFICATION
145-IN WHEELBASE, 3.5L GTDI	
FRONT	114 MM (4.488 IN) ± 12 MM (0.472 IN)
REAR	164 MM (6.456 IN) ± 12 MM (0.472 IN)

Ride Height — Four-Wheel Drive (4WD) Crew Cab — Heavy Duty — Max TT

ITEM	SPECIFICATION
145-IN WHEELBASE, 3.5L GTDI	
FRONT	121 MM (4.763 IN) ± 12 MM (0.472 IN)
REAR	171 MM (6.732 IN) ± 12 MM (0.472 IN)

Ride Height — Rear Wheel Drive (RWD) Crew Cab — Heavy Duty

ITEM	SPECIFICATION
145-IN WHEELBASE, 3.5L GTDI	
FRONT	118 MM (4.645 IN) ± 12 MM (0.472 IN)
REAR	158 MM (6.220 IN) ± 12 MM (0.472 IN)

Ride Height — Four-Wheel Drive (RWD) Crew Cab — Heavy Duty — Max TT

ITEM	SPECIFICATION
145-IN WHEELBASE, 3.5L GTDI	
FRONT	116 MM (4.566 IN) ± 12 MM (0.472 IN)
REAR	166 MM (6.535 IN) ± 12 MM (0.472 IN)

Vehicle Lean (side-to-side height differences), All Vehicles

ITEM	SPECIFICATION
FRONT — MAXIMUM	7 MM (0.276 IN)
REAR — MAXIMUM	8 MM (0.315 IN)

POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Electrical Basics

Inside a vehicle, electricity is supplied through powered, or hot, wires. This is comparable to the pressurized supply pipes of a plumbing system. At various points along the wires are outlets in the form of lights, switches and receptacles. Turning on a light switch allows the electric current to flow through the hot wire to illuminate the light. Once the electricity has done its work, its potential drops to zero, just as water loses pressure after flowing through a sink or laundry tub. The electrical system uses ground wires to return the current to its source. Just as a plumbing system has drainpipes through which water runs into the sewer mains or the ground.

The light or equipment powered by the current, technically called the load, can be compared to a water wheel that remains motionless until a stream of water causes it to turn. A load may be one of 2 kinds. The first consists of a resistance — a material that permits the passage of electric current, but only with difficulty, and thereby creates heat. The tungsten filament of an incandescent bulb is resistance; so is the heating element of an electric heater of a coffee pot. A load may also be an inductance — typically a motor with windings of copper wire, in which the magnetic fields generated by the current create motion. At any moment, the demand on an electrical system depends on the number of loads in operation and their consumption of energy, just as demand on a water system depends on how many faucets are opened and how wide they are opened.

The mechanics and physical fittings of the system are simple. Current moves throughout the vehicle in wires of different sizes, according to the current a circuit may have to carry. Power is supplied directly to equipment through connectors.

Electrical Terms

VOLT is the unit of electrical potential, equal to the difference of electrical potential between 2 points on a circuit.

AMPERE is the unit used to measure the amount of current - that is, the number of electrically charged particles called electrons - that flows past a given point on a circuit each second. It is similar to measuring the amount of water flowing through a pipe at any given point. The larger the pipe is, the more water that can flow past the point per second. Similarly, the bigger the wire is, the more current that can flow through it at any given point. Current that has lost its voltage still has amperage as it completes the circuit and returns to the battery.

WATT is the unit of power. It indicates the rate at which a device converts electric current to another form of energy, either heat or motion, or to put it another way, the rate at which a device consumes energy.

The relationship of volts, amperes and watts to one another is expressed in a simple equation that enables you to make any calculations you may need for correct and safe electrical modifications to the vehicle. Volts x amperes = watts. If the current is at 12 volts and a device requires 4 amperes of current, the equation will read 12 volts x 4 amperes = 48 watts.

To figure the current needed for a device rated in watts, turn the equation around: watts/volts = amperes. For example, if you have a piece of equipment, such as a communications radio, which uses 120 watts: 120 watts/12 volts = 10 amperes.

Electrical Systems Management

Care must be given in deciding what equipment should be installed into a police vehicle given the power demands of the equipment and the power available from the vehicle. A power load strategy should be developed to minimize the risk of running out of power. Examine the proposed equipment for vehicle installation. Add up the current requirements. If the current requirements exceed what the vehicle can reasonably be expected to be able to provide, the battery will begin discharging to provide the power to the equipment that the generator is unable to provide. After some period of time, the vehicle will shut off as the battery voltage decreases to a level that cannot sustain vehicle operation.

There are alternatives that can be considered to minimize system electrical overload. Consider the current requirements of equipment before it is purchased and installed. Modern light bars and radios use a fraction of the current than units made as recently as 1996. As the light bar is typically the most power intensive unit installed on most police vehicles, considerable attention should be given to its current requirements.
Changes in officer habits while in the field can make a difference as well. When a vehicle is sitting at an accident scene and no one is in the car, the A/C can be turned off until the officer is ready to get back into the vehicle. The A/C is among the largest current users of non-police equipment. As such, it can impact available power for other uses as well.

Generator Output

The 240-amp generator used by the F-150 is controlled by the Powertrain Control Module (PCM).

Charging Margins

Generator output varies with engine speed and ambient temperature. The worst case for police vehicles is when the vehicle is idling for long periods of time on a very hot day. Lower engine speeds while idling, coupled with high underhood temperatures that may approach 93°C (200°F), combine to minimize power output from the generator. At the same time, electrical demand on the vehicle is often at its highest because the A/C loads are added to the usual electrical loads experienced in emergency situations.

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Vehicle Component Electrical Loads

Vehicle component electrical loads are shown in the table below. Not all features are powered all the time, so actual vehicle loads on the power supply system will vary.

Component / Amps:

Base

- Miscellaneous Base Loads - 19.6 Amps

Cooling

- Cooling Fan (Inc. High) 800w X 75% - 43.4 Amps

Climate Control

- A/C Clutch - 3.3 Amps
- A/C Fan-to-Face - High Speed - 21.3 Amps
- A/C Fan-to-Face - M/H Speed -17.2 Amps
- Heater Fan-to-Foot - M/H Speed -12.2 Amps
- Heater Fan - Defrost - High Speed - 16.9 Amps
- Rear Climate Control - 56.8 Amps

Lighting

- Ext. & Instr. Panel Lamps (Non-dimm.) - 3.2 Amps
- Headlamps Low Beam - 8.9 Amps
- Headlamps — High Beam (Incremental) - 9.9 Amps
- Incandescent Brake Lights With Chmsl - 10.7 Amps

Heated Features

- Heated Rear Windows - 21.4 Amps

Other

- Radio - 6.0 Amps
- Front Wiper Low Speed - 4.0 Amps
- Electric Trailer Brake - 8.0 Amps

Typical Vehicle Load = 140- 170 Amps

Typical Police Equipment

Loads for equipment commonly found on police vehicles are shown in the table below. Not all equipment will be operating at the same time, so actual loads on the power supply system will vary.

Component / Amps:

- Communications Radio - 4.0 Amps (8.0 w/Microphone Active)
- Mobile Data Transmitter - 3.0 Amps
- Light Bar - 28-43 Amps
- Light Bar w/ All Internal Acc. Lights Activated - 36-63 Amps
- Spotlights (Each) - 7.8 Amps
- Alley Lights (Each) - 1.0 Amps
- Radar - 0.8 Amps
- Camcorder - 0.5 Amps

Powertrain Control Module (PCM) — Red Area

NOTICE: DO NOT make electrical connections to vehicle electrical systems not specifically designed for police equipment installations. Damage to the electrical system can occur.

Do not install any components into the PCM or PCM harness. Connecting into this system may affect engine and transmission operation. Connecting any aftermarket electrical equipment into the brake light circuit or any other circuit connected to the PCM, anti-lock brake computer, air bag system or any other vehicle system will cause a vehicle malfunction.

Disabling Brake Lights

Do not disable the brake light circuits for any reason. For additional information, refer to Section 1: General Information in this guide.

Auxiliary Power Point (12V DC)

NOTICE: Do not plug optional accessories into the cigar lighter socket (if equipped). Incorrect use of the lighter/socket can cause damage not covered by the warranty.

NOTICE: Power outlets are designed for accessory plugs only. Do not insert any other object in the power outlet as this will damage the outlet and blow the fuse. Do not hang any type of accessory or accessory bracket from the plug. Incorrect use of the power outlet can cause damage not covered by the warranty.

The auxiliary power point is located on the instrument panel. Do not use the power point for operating the cigar lighter element (if equipped). To prevent blowing the fuse, do not use the power point(s) over the vehicle capacity of 12V DC/180W. If the power point or cigar lighter socket is not working, a fuse may have blown. To prevent the battery from being discharged, do not use the power point longer than necessary when the engine is not running. Always keep the power point caps closed when not being used.

Sealing Pass-Thru Points/Openings

Underbody

Any holes in the body must be sealed with Motorcraft® Seam Sealer (TA-2-B).

Any damaged parts must be replaced. Following are some examples:

- spare tire tub
- auxiliary A/C pass-through
- air extractors (replace if damaged)
- wiring grommets
- body plugs
- floor pan

Examples of wiring pass-throughs that were sealed incorrectly and correctly Proper care and due diligence must be used on all openings at any location on the vehicle from the dash panel to the rear of the vehicle.

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Dash Panel

Any seals and/or holes in the dash panel must be replaced and/or properly sealed using Motorcraft® Seam Sealer (TA-2-b).

Sealing Option for Body Openings/Pass-Through Points

- Pass-through or other openings of similar size should be sealed using the recommended foil-backed mastic patch.
- Foil-backed mastic patch should be used to cover and seal body openings.
- Part number for foil-backed mastic patch:
- Following are service part numbers for two different size foil-backed mastic patches:
- 4L3Z18203A16AA; size of patch - 1.5 x 147 x 330mm
- DA5Z65203A16A; size of patch - 1.5 x 100 x 300mm

Decommissioning

Vehicle Sealing of Aftermarket Equipment

At the end of its useful life as a police vehicle, many vehicles are decommissioned having lights, wiring and other equipment removed, and vehicles are sold for other uses such as retail applications. The openings remaining in the body/components are potential leak paths for exhaust gas into the cabin under certain conditions. These openings must be sealed prior to the vehicle going to auction or any other application.

When customized equipment has been removed from your vehicle, body panels and seals may be compromised. Thoroughly inspect your vehicle for any signs where the equipment has been removed, for example: holes and damage to body seals.
Any openings should be sealed with a plug and a sealant. The opening can be modified to enable a plug to seat properly promoting a better sealing surface. The sheet metal surface with the opening should be treated to prevent corrosion prior to inserting the plug and sealant. Any items that remain on your vehicle must be inspected and any sign of damage repaired immediately. Failure to follow this instruction may result in water and exhaust fumes entering the passenger compartment.

See your authorized ford dealer for more information and direction regarding proper sealing procedures.

COMMON FORD PLUG PART NUMBER	HOLE DIAMETER
W716284–S	0.859 INCHES / 21.83 MM
W714104–S	1.07 INCHES / 27.25 MM
W711539–S	1.378 / 35.0 MM
W651021–S	1.683 INCHES / 42.75 MM

Tools For Creating a Circular Opening

Two suggestions for tools that can be used for creating and/or modifying an existing opening for a plug are a Knockout Punch or Step Bit.

General Guidelines

- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Document all revisions to the electrical system and place with the vehicle Owner's Literature. Color code and/or label all revisions or additions to wiring.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Disconnect the negative battery cable of vehicles stored on-site to reduce the possibility of draining the battery by lights or other equipment.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 5: Reference Information in this guide.
- Do not install switches and gauges in the driver or passenger knee impact areas.
- Inspect all Ford gauges, lights and switches for correct operation after instrument panel work is performed.
- Correctly secure all wiring relocated or removed while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Provide adequate retention for wiring harnesses so that they are clear of bolts, corners or edges which could abrade the wires during normal vehicle operation.
- Anticipate misrouted wiring situations and protect all wiring from penetration by screws and raw edges. See Wire Routing for further information.
- Weather seal all exposed electrical connections exposed to the elements.
- Do not use quick splice connectors or wire nuts.
- Install the fuse panel so fuses are readily accessible.
- Make sure that connections are easily accessible for assembly and service.
- Make sure submersible connectors do not lose their seals under extreme assembly conditions such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.

POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

General Guidelines (Cont'd)

- Supplemental restraint systems must remain intact as received from Ford Motor Company. Before modifications are done to the vehicle, the system must be disarmed by following the instructions provided in the current F-150 Workshop Manual.
- Adherence to the above guidelines is not to be understood as approval by Ford Motor Company of any specific revisions or additions to the vehicle's original electrical system.

Keep Alive Memory (KAM) Power

The electronic engine and transmission control modules require battery power to be supplied at all times to maintain the KAM. Keep this in mind when installing load disconnect switches or solenoids.

Equipment Grounding Guidelines

- Factory ground locations are not to be removed for any reason.
- Do not ground the body to the transmission or transmission crossmember. Ground accessories to the chassis or the vehicle battery.
- Splicing into circuitry relating to the electronic engine and/or transmission control systems is not acceptable because of the adverse effect on the electronic system operation.
- Protect exposed electrical connections.

Wire Insulation

- Polyvinyl Chloride (PVC), rated at 90°C (194°F), is the standard wire insulation that is acceptable for inside body use, but is not acceptable for underhood/underbody wiring.
- Hypalon insulation should be used on links only (Ford Specification ESB-M1L54-A).
- Cross-linked Polyethylene (XPLPE or SXL), rated at 135°C (275°F), is the required insulation for underhood/underbody applications (Ford Specification ESB-M1L123-A).
- GXL can be used as an alternate wire (Ford Specification ESB-M7L85B) as long as the concentricity specifications are met. To provide a water-resistant seal in conjunction with crimp connectors, a Duraseal crimp connector is recommended since it is designed to account for outside wire diameter that is smaller than the present SXL wire.

Terminals and Connectors

Connector Types

- Submersible (sealed) — A connector capable of being immersed in water.
- Weather-resistant — A connector that will retain its sealing and connection qualities while being exposed to adverse weather conditions.
- Duraseal crimp — A supplier trade name for a sealed wiring repair or splice.

When a connection is not defined (typical situation — harness-to-harness connectors), the following suggestions should be implemented:

- Determine the connector type. If it will be located in a hostile environment, use a submersible (sealed) connector; if not, use an open connector. A hostile environment is defined as being exposed to water and/or salt accumulation and/or high temperatures (for example, underhood, exterior panels and footwells). Use in-line connectors with secondary locks to prevent the terminal from being pushed out.
  - Do not use single wires smaller than 14-gauge in a 2-way or larger weather-resistant connector (the very large style), since the wire may break during disengagement.
  - Use Hypalon, XLPE or Elexar insulation in submersible connectors to maintain sealing integrity. PVC is not acceptable because it cold flows and allows setting in a deformed pattern, therefore compromising the integrity of the seal.
- Determine the terminal type. Base your decision on wire gauge, current carrying capacity, connector type and insulation type.
  - Use non-detent low insertion force terminals whenever possible.
  - Do not use low insertion force female terminals in weather-resistant connectors.
  - Analyze circuit requirements (signal levels, current, voltage) to determine the correct plating material (such as gold). Use of non-plated terminals is not recommended.
  - Do not use plugs to seal holes in micropin connector grommets. It is very easy to forget to insert them during manufacturing and ruin the seal. Use a grommet with only the necessary number of holes or use dummy wires at least 600 mm (24 in) long.
  - Fully align connectors prior to terminal connection — terminal cavities should have minimum tolerance to prevent terminals from floating, bending or pin push-out during mating/engagement.
  - Make sure connectors of similar type and color can be identified by operator to eliminate crossed connections and minimize assembly time. Avoid using similar types and colors of connectors close together.
  - Be sure that connectors have positive locking devices that allow easy installation with a low insertion force and easy removal. The connector snap should be easily felt and heard.
  - Eliminate the use of edge board, tang-type and molded-over connectors. The use of blade-type weather-resistant connectors is restricted to high-current applications which cannot be handled by submersible connectors.

Circuit Protection and Electrical Load

- Modification to existing vehicle wiring should be done only with caution and careful consideration of effects on the completed vehicle electrical system. Anticipated circuitry should be studied to determine the required circuit protection and to avoid feedback loops.
- Added circuitry must be protected either by a base vehicle fuse or circuit breaker, or by a similar device supplied by the modifier.

POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Circuit Protection and Electrical Load (Cont'd)

- When adding loads to a base vehicle-protected circuit, make sure that the total electrical load through the base vehicle fuse or circuit breaker is less than the device's load rating.
- Use 80% of the fuse rating to determine maximum steady state load to reduce nuisance fuse failures.
- Use 135% of the fuse rating when sizing wiring to protect the circuit in the event of an overload. Fuses will last for 1 hour at 135% of their rating.
  - Total current draw is the sum of the base vehicle's circuit current requirement (measured with an ammeter) and the anticipated add-on component current requirements.
  - Never increase the rating of a factory installed fuse or circuit breaker.
  - If the total electrical load including additional electrical components on any circuit, is less than the fuse protection rating or the capacity of some limiting component (switch, relay), the items to be added can be connected directly to that circuit. The headlamp switch circuits should never have additional lighting or electrical components directly connected.
  - Added devices that exceed the current capabilities of the factory-installed system are best controlled through the use of a relay or separate switch. The coil of the relay can be fed from the circuit in the factory harness (now acting as a signal circuit) with added wiring providing feeds to the added electrical device. The relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time and whether the relay is exposed to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, the load should be reduced or divided through the use of additional relays.

Wire Protection Requirements

General Notes

- Anticipate problems and design accordingly. Try to anticipate what could go wrong and modify your designs to address any adverse impact.
- Review all connector applications and electrical systems to determine the need for solder, grease, weather-resistant or sealed connectors. Make sure components and wire insulation are compatible with greased connectors (important for long-term durability).
- Make sure that drip loops or other means are provided to prevent water leakage into the vehicle through wiring assemblies that pass through the dash panel.
- Use greased or sealed connectors in floor pan troughs which are subject to moisture coming through the carpeting.
- Use XLPE insulation for uncovered runs that exceed 305 mm (12 in).

Electrical Protection

- Correctly route wires away from noise-generating wires or components. However, if routing near noisy wires or plugging into noisy components is unavoidable, additional protection must be designed into the harness.
- Shielding — Electro Magnetic Interference (EMI) — Consider shielding if you must route close to high-current or noisy circuits. Use shielded wire and ground one side. Seal all splices in wire assemblies that use bare coaxial shielding (braid or tape) for EMI suppression and insulate or tape over all shielding ends that terminate near any open connectors. This prevents splice and terminal shorts to the shielding. Minimize the length of conductors which extend beyond the shield. Failure to do this reduces the effectiveness of the shield.
- Spike suppression, in general, is accomplished by connecting a diode or resistor-diode combination across the terminals of the noisy component. The diode should be sufficiently close to the component (both electrically and physically) so that inductive spikes are clamped off. Make sure the diode is connected with the correct polarity.

Correct routing and retention will reduce the likelihood of chafing or pinching. When this ideal routing is unattainable, the following additional protection is needed:

Mechanical/Environmental Protection

- Tape — Tape is the most basic means of protection. It contains the wires in a loose bundle and provides limited environmental protection. It does not protect against chafing and pinching.
  - Kendall Polyken Fiberglass Base Tape (Ford Specification ESB-M3G38-A) is used for engine compartment applications. This durable tape provides against cut-through, and abrasion commonly found in underhood applications.
  - Polyken 267 is a substitute tape that may be used in lower temperature areas of the engine compartment (apron area).
- Convolute - Use convolute for all underhood/underbody applications or when increased temperature, abrasion or pinch resistance is required. Convoluted tubing comes in different diameters and materials to accommodate different temperature ranges and harness sizes.
  - Use polyethylene convolute when abrasion is the only consideration; this convolute is adequate up to 96°C (205°F) maximum. Use nylon convolute when underhood/underbody or abrasion and temperature are considerations; nylon convolute is adequate up to 177°C (350°F) maximum.
  - On all engine-mounted wiring or bend points, use vinyl tape on the outside of the convolute to prevent wiring from looping out. This tape must be able to withstand temperatures 135°C (275°F) or higher.
  - Tape convolute junctions with abrasion-resistant tape (Polyken 267, fiberglass).
- Scroll — Similar to convolute, but without the ridges. Scroll is used where harness rigidity is required, especially for maintaining critical locator dimensions. Use scroll for short lengths only, as it is quite inflexible.

Mechanical/Environmental Protection (Cont'd)

NOTE: This is not meant to be an all-inclusive list of methods for physically protecting the wires. There are other means of protection available that are not listed.

Grommets and Sealing Requirements

Any additional wiring routed through sheet metal must pass through a grommet that both seals the opening and locates the wire(s). Two-piece grommets (rubber with plastic inserts) are recommended to facilitate installation and retention.

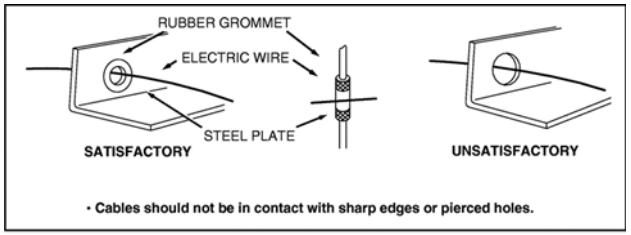
- Locate grommets so they are accessible for correct seating (achieved by pulling) in sheet metal holes.
- Ramp grommets at the insertion end to facilitate installation and sealing.
- Be sure the direction of the hole punch is in the direction of grommet seating and the hole is burr-free.
- Make sure the grommet molding compound will adhere to the harness to prevent slippage.
- Make sure the grommet will withstand the environment (temperature, splash).
- Be sure that holes are large enough to allow the harness to be installed without causing circuit damage.
- Use adhesive tape on main trunks or branches with at least a 50% overlap to prevent wicking through grommets. Be certain to diaper- wrap the takeouts.

Wire Routing

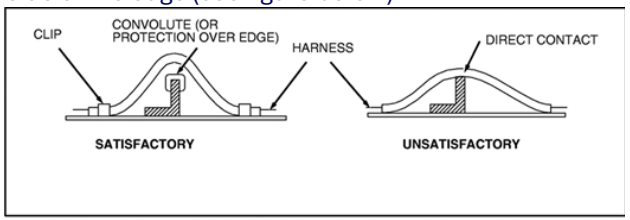
WARNING: Do not place electrical component attachments or ground screws adjacent to vehicle fuel tanks, fuel filler pipes, fuel lines, fuel vapor lines or carbon canisters. Failure to follow these instructions may result in personal injury in the event of a collision.

Wire harness routing should conform to the following:

- Protect wires routed through holes in sheet metal or castings with a grommet whether or not conduit is used (see figure below).



- Route wires to avoid metal edges, screws, trim fasteners and abrasive surfaces. When such routing is not possible, use protective devices (shields, caps) to protect the wires. Cover metal edges with a protective shield and fasten the wiring within 76 mm (3 in) on each side of the edge (see figure below).

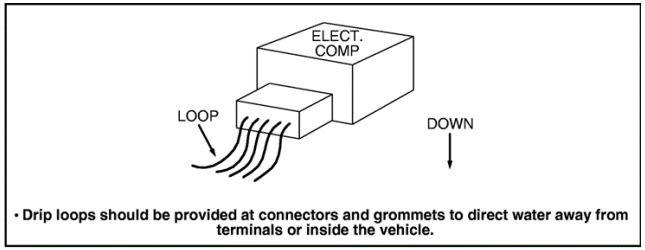


- Route wires to provide at least 76 mm (3 in) of clearance to moving parts in their extreme movement location, unless positively fastened and protected by a conduit.
- Avoid wire routing without conduit in areas where temperatures exceed 82°C (180°F). Maintain a minimum clearance of 152 mm (6 in) from exhaust system components. Heat insulation and heat shields must be used on the wires routed in high temperature areas.
- Make certain all underhood or underbody wiring is cross-linked polyethylene high temperature insulation wire with a 135°C (275°F) minimum rating, consistent with SAE specification J1128 Type SXL wire. Do not use normal PVC wire in underhood or underbody applications.
- Make sure all ground locations are readily accessible for installation, service and verification.
- Do not place ground attachments in high-splash areas.
- Do not route underbody wiring over the exhaust system.
- Route the underhood/underbody wiring in conduit for protection. Minimum conduit rating is 177°C (350°F).

Wire Retention and Routing

Use the following criteria to determine the location of retainers:

- Size and weight of wire bundle.
- Holes with poor accessibility that prevent installation of locators.
- Movement of wires that can result in abrasion, squeaks and rattles.
- When wiring is routed between 2 members where relative motion can occur, secure the wiring to each member with enough wire slack to allow flexing without damaging the wire.
- Wiring exposed to weather must provide a drip loop to prevent moisture from being conducted into the device through the wire connection (see figure below).


ELECT. COMP
LOOP
DOWN
• Drip loops should be provided at connectors and grommets to direct water away from terminals or inside the vehicle.

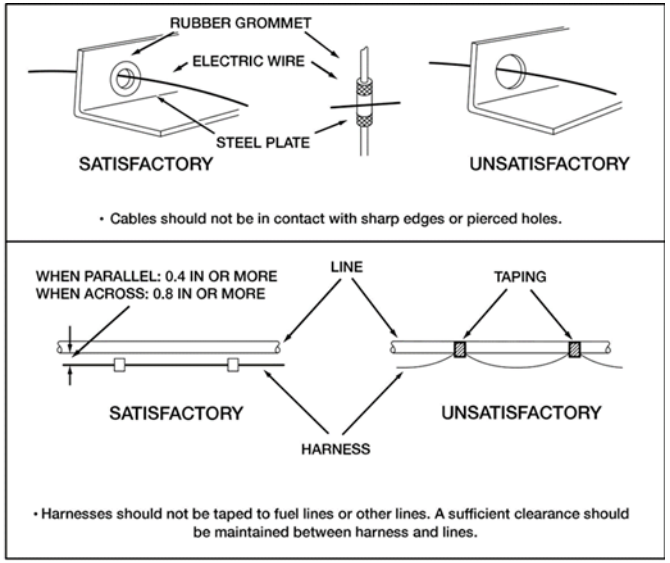
- Avoid routing wires into areas exposed to wheel splash. When such routing cannot be avoided, adequate clipping and/or protective shields are required to protect the wires from stone and ice damage. Allow adequate slack in wiring between the engine and stationary components to compensate for engine roll.
- Avoid routing wires under the frame side members or at points lower than the bottom frame flange.
- Use plastic cable ties for bundling only (securing to other wires).

POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Wire Retention and Routing (Cont'd)

- The wire retainers and grommets installed by the assembly plant are usually designed to accommodate only the Ford-installed wires. Additional wiring or tubing should be retained by additional clips. When additional wiring or tubing are routed through sheet metal panels, new holes with correct wire protection and sealing must be used.

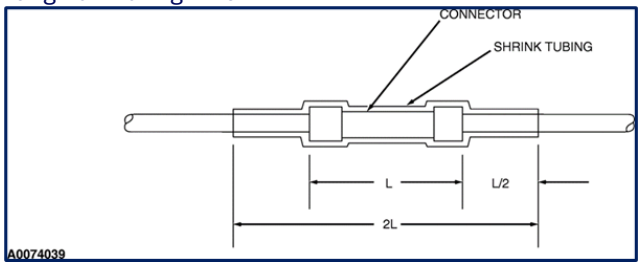

RUBBER GROMMET
ELECTRIC WIRE
STEEL PLATE
SATISFACTORY
UNSATISFACTORY
• Cables should not be in contact with sharp edges or pierced holes.
WHEN PARALLEL: 0.4 IN OR MORE
WHEN ACROSS: 0.8 IN OR MORE
LINE
TAPING
SATISFACTORY
UNSATISFACTORY
HARNESS
• Harnesses should not be taped to fuel lines or other lines. A sufficient clearance should be maintained between harness and lines.

For retainer screws, the following guidelines apply:

- Avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system and suspension.
- Do not use pointed screws for attachments. Also check that screws used in the vicinity of the wiring are blunt ended.
- To minimize the potential for wiring shorts, do not use drill point screws. Trim components (including wiring shields) should use pin-type attachments instead of screws.
- Always check areas that screws protrude into for verification that an interference condition to other components does not exist.
- Make sure that retainers used are capable of withstanding the environment over the vehicle's life expectancy.

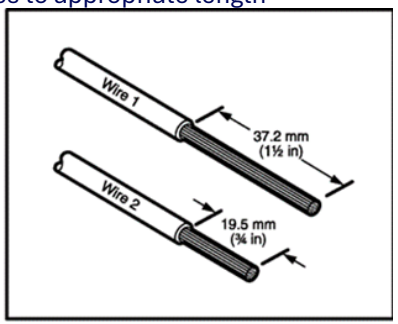
Splices and Repairs

- For quality splicing and to reduce potential problems, the following guidelines are recommended:
- Stagger the splices within a harness to reduce increased harness diameter. Splice only on straight areas as installed, not on bends.
- Strip wire ends making sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only resin-core solder. Acid-core solder should not be used since it may result in corrosion.
- For crimp joints, use butt-type metal barrel fasteners and the correct tool at the appropriate setting for the wire size (such as Motorcraft® Crimp Tool S-9796) specifically designed for this type of work.
- Make sure splice joints are adequately sealed and insulated. In an outside environment, use Duraseal butt connectors or equivalent. A durable substitute splice joint can be achieved by using a bare metal barrel, crimping, flow-soldering and covering with shrink tubing. Quality electrical tape can be used inside the vehicle but is not recommended for an outside environment.
- Be sure the new wire is not a lesser gauge than its original mating wire.

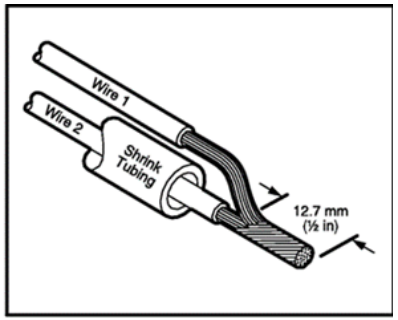


Recommended Splicing Method — Solder (For 16 AWG and Smaller Diameter Wire Only)

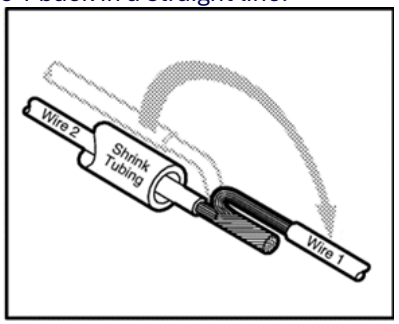
1. Disconnect the battery ground cable.
2. Strip wires to appropriate length



3. Install heat shrink tubing.
4. Twist the wires together.
5. NOTE: Use resin-core mildly activated (RMA) solder. Do not use acid-core solder. Solder wires together.

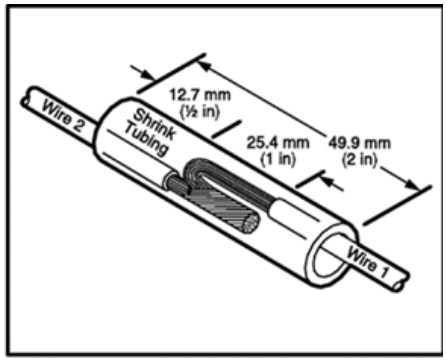


6. NOTE: Wait for solder to cool before moving wires. Bend wire 1 back in a straight line.

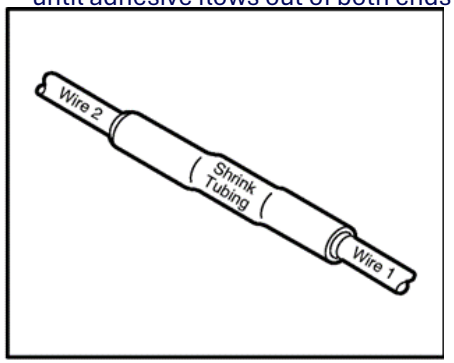


7. NOTE: Overlap tubing on both wires. Evenly position heat shrink tubing over wire repair.

Wire Retention and Routing (Cont'd)



8. Use a shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat



9. Reconnect the battery ground cable. Sealed Connectors

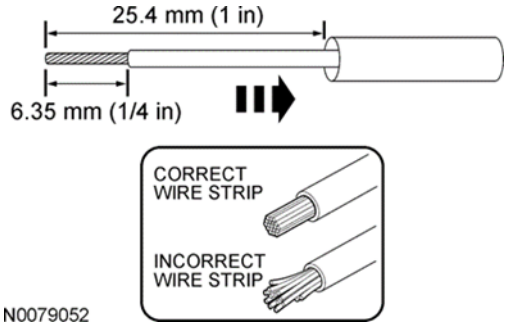
FORD PART NUMBER	PART NAME	CLASS
E6FZ-14488-A	BUTT CONNECTOR GAUGE: 18-22, COLOR: RED	C
E6FZ-14488-B	BUTT CONNECTOR GAUGE: 14-16, COLOR: BLUE	C
E6FZ-14488-C	BUTT CONNECTOR GAUGE: 10-12, COLOR: YELLOW	C

Heat Shrinkable Tubing (Heat Shrink) (Ford Specification ESB-M99D56-A2)
Heat shrinkable tubing is available in various diameters for different splice sizes and configurations. When shrunk, it forms a small, flexible hermetic seal.

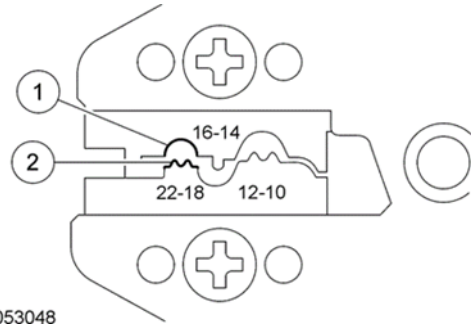
Other methods (tape, PVC mold) do not provide a hermetic seal and are not recommended. Splice balancing is critical with heat shrink insulation. If the splice is extremely unbalanced (more circuits on one side than the other), heat shrink insulation will not provide a correct seal. Evaluate the use of double terminals instead of splices where practical in these situations.

Recommended Splicing Method — Crimp (For 10–22 AWG Diameter Wire to Like Wire Diameter)

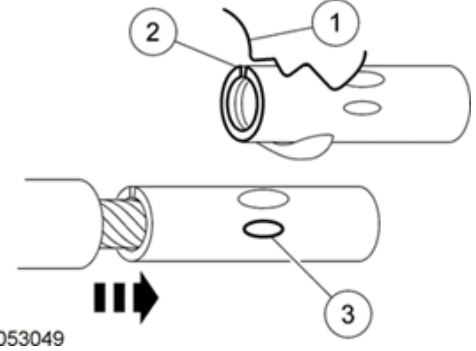
1. Disconnect the battery ground cable.
2. Strip wires to appropriate length.
3. Install heat shrink tubing.



4. Select the appropriate wire splice for the wires to be spliced from Rotunda Wire Splice Kit 164-R5903.
5. NOTE: Rotunda 164-R5901 Pro-Crimper supplied with the wire splice kit is the only tool that can be used with these splices.
   Identify the appropriate chamber on the Rotunda Pro-Crimper by matching the wire size on the dies with the wire size stamped on the butt splice.
   i. Cavity
   ii. Indenter



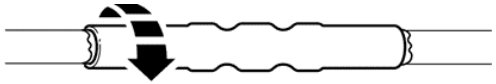
6. Crimp the connector.
   i. Center one end of the wire splice in the appropriate crimping chamber.
   ii. Insert stripped wire into the barrel.
   iii. Holding the wire in place, squeeze the tool handles until ratchet releases.



7. Repeating Step 6, crimp the other half of the splice.
   i. Check for acceptable crimp.
   ii. Crimp should be centered on each end of the butt splice.
   iii. Wire insulation does not enter butt splice.
   iv. Wire is visible through inspection hole of splices.
8. Check for acceptable crimp.
   i. Crimp should be centered on each end of the butt splice.
   ii. Wire insulation does not enter butt splice.
   iii. Wire is visible through inspection hole of splices.

Wire Retention and Routing (Cont'd)

9. Evenly position supplied heat shrink tubing over wire repair.
10. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing.



N0070450

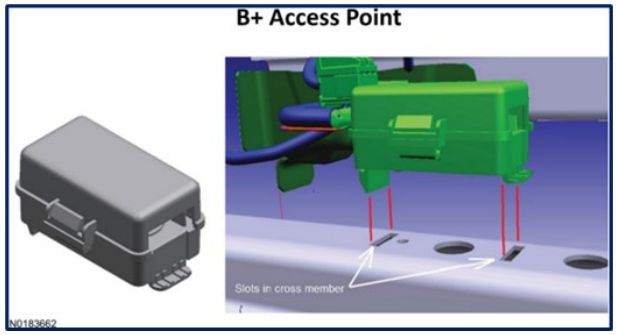
11. Reconnect the battery ground cable.

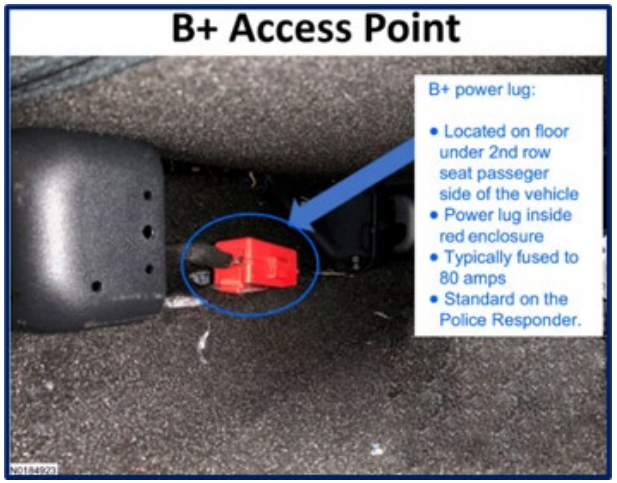
Electrical items for the F-150 Police Responder

- Location on dash panel to pass power through from the battery to police equipment in the cab/bed.
- Brake signal, pin number, wire color.
- Battery power access point and fuse rating, pin number, wire color.
- Ignition power access point and fuse rating.
- Vehicle speed output.
- Driver door ajar signal.
- Start fuse number/location (i.e., Battery Junction Box (BJB)), wire color.
- Accessory delay fuse number/rating, location , wire color.

Battery Power Access Points

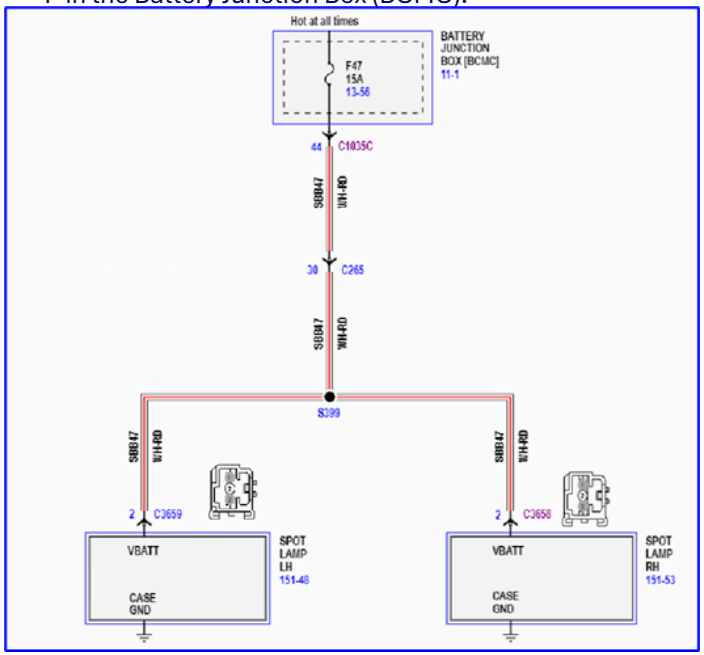
- Located under the second-row passenger seat on the floor of the vehicle.
- B+ power lug is inside the red enclosure.
- Typically fused to 80 amps.
- Standard on the Police Responder.




B+ Access Point
B+ power lug:
• Located on floor under 2nd row seat passeger side of the vehicle
• Power lug inside red enclosure
• Typically fused to 80 amps
• Standard on the Police Responder.

Spot Lamps

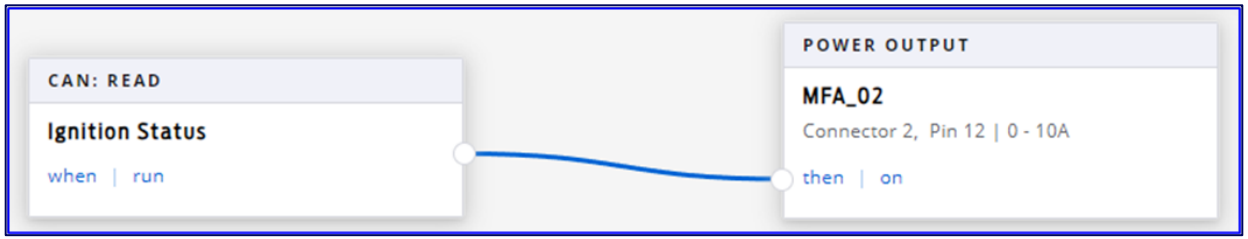
- The Police Spot Lamps draw power through fuse FBB47-P in the Battery Junction Box (BCMC).



FOR THE FOLLOWING SIGNALS, THE VEHICLE INTEGRATION SYSTEM 2.0 WILL NEED TO BE PROGRAMMED.

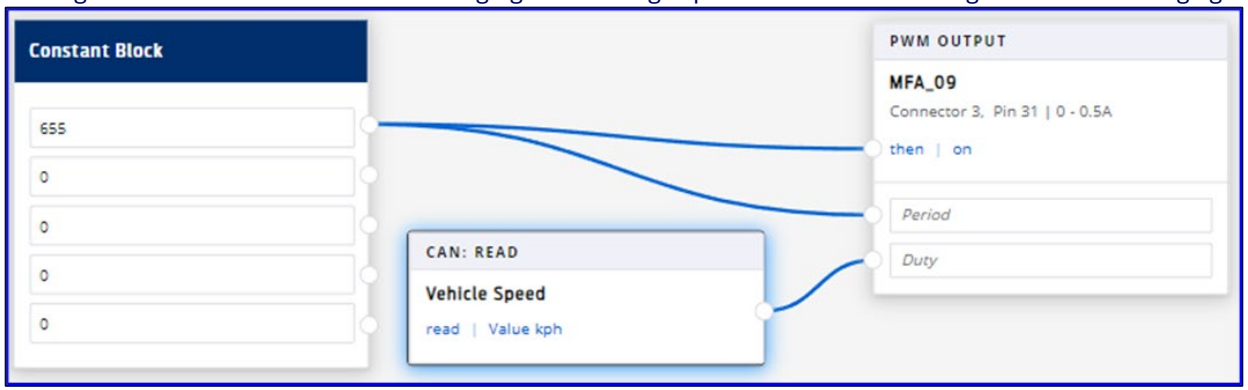
Ignition Power (Run/Start) Signal

- Run/Start signal can be programmed to output on pin 12 (CAC51A BU-OG) of the 12-pin connector C2 located at Vehicle Integration System 2.0.
- The FET is rated at 10A.



Vehicle Speed Output

- Vehicle Speed signal can be programmed to output a duty cycle on pin 31 (CAC69A BU/GN) of the 40-pin connector C3 located at Vehicle Integration System 2.0.
- Vehicle speed can be programmed to output a duty cycle.
- The vehicle speed (Speedometer) reading is communicated via CAN messaging over the high speed 2 network or through the CAN message gateway.



Driver Door Ajar

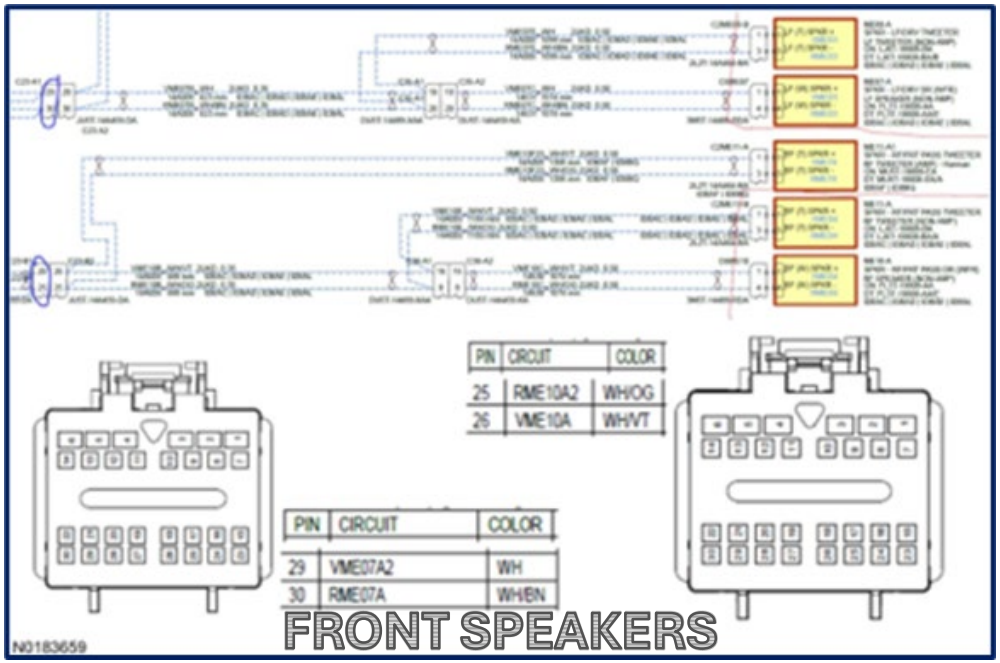
- Driver door ajar signal is available via Vehicle Integration System 2.0 Connector 2 Pin 11
- WAC67A GN/VT.

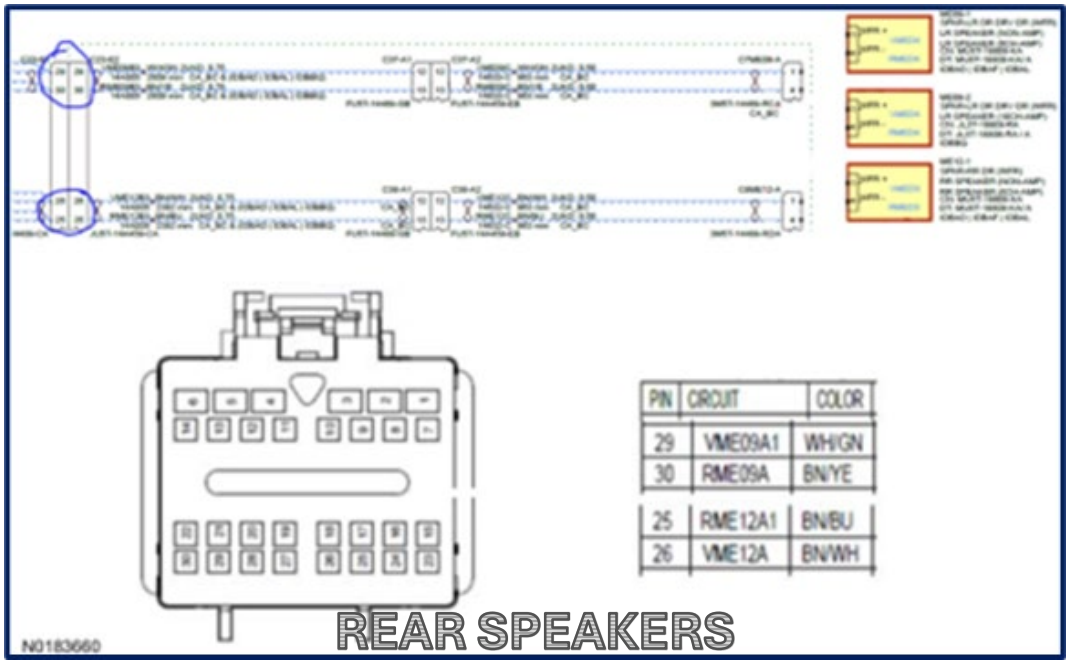
Brake Signal

- A brake lamp output signal can be programmed to output a 5-amp, 12-volt output signal when the brake pedal is depressed on pin 6 (CAC48A WH/GN) of the 12-pin connector C2 located at Vehicle Integration System 2.0.

Police Radio Speaker Outputs

- Left Front speaker positive and negative circuits are available in the 30-pin connector located by the drivers outboard footwell at pins 29 wire color White (WH) and 30 wire color White/Brown (WH/BN).
- Right Front speaker positive and negative circuits are available in the 30-pin connector located by the passengers outboard footwell at pins 26 wire color White/Violet (WH/VT) and 25 wire color White/Orange (WH/OG).
- Left Rear and Right Rear speakers positive and negative circuits are available in the 30-pin connector located between the front seats under the center floor console at pins 29/30 and 26/25 wire color White/Green (WH/GN) Brown/Yellow (BN/YE) Brown/White (BN/WH) Brown/Blue (BN/BU).
- Center speaker positive and negative circuits are available in the 2-pin connector located at the center speaker top of the instrument panel wire color Green (GN) and Gray/Yellow (GY/YE).





POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

How To Change Option Content

Rear Power Window Disable

The optional rear power windows of the F-150 Police Responder can be disabled by disconnecting the rear window motor connectors. These connectors are located inside the door, behind the door trim panel and must be secured to prevent interference with the window mechanisms. While they are disabled, the master window control switch will not control the rear windows. Refer to F150 Wiring Diagrams Manual for additional power window wiring information.

Wiring Reference Information

Ordering Information

To obtain information about ordering complete copies of Ford or Lincoln/Mercury publications, call 1-800-782-4356.

Available publications include Workshop Manuals, Wiring Diagrams, PC/ED Manuals and Owner's Literature.

In addition, a publications order form can be obtained by writing to:

Ford Publications, c/o Helm Inc.
P.O. Box 07150
Detroit, MI 48207

Please Note: under Ford Pro Body Builder Advisory Service (BBAS) – under Publications, under "Police Modifier Bulletin" – please see *Bulletin P-036* "Ford Pro Vehicle Integration System 2.0" (which is available for download)

Please review for: Content, Information & Support, System 2.0 Access, Electrical Overview, Power On/Off Strategy, Location (Equipment from Factory, J1939 Output Signals, Customer CAN-Signal Access, & Channel/Signal Outputs.

FORD PRO - VEHICLE INTEGRATION SYSTEM 2.0 2024MY F-150 POLICE RESPONDER

POLICE MODIFIER BULLETIN P-036

MODEL(S) AFFECTED:
2024MY and Beyond F-150 Police Responder

Description / Overview:

Introduced for the F-150 Police Responder, the new Ford Pro Vehicle Integration System 2.0 allows for Upfitter(s) to install or operate vocational upfits. This hardware/software solution allows to seamlessly integrate equipment on the truck. Upfitters with a FIN code can sign in and begin using the Vehicle Integration System 2.0 software by click on this link: Ford Pro™ Login (b2clogin.com) .

The Vehicle Integration System 2.0 consists of a Vehicle Integration System 2.0 hardware module that allows upfitters to access the vehicle J1939 Control Area Network (CAN) signals of a Vehicle Integration System 2.0 equipped F-150 Police Responder and digitally connect the upfit to the vehicle. The upfitters can then use the cloud-connected Upfit Logic Editor to program physical switches, digital SYNC soft buttons, and alerts inside the cab. The common interface of the Vehicle Integration System 2.0 allows upfitters to deliver custom, consistent, and repeatable solutions to their customers.

Two-way communication between vehicle and the upfit becomes more streamlined and reliable. Peripheral devices – such as light bars, , sirens, etc. – can be directly connected and controlled from soft buttons within the Ford SYNC screens.** Vehicle Integration System 2.0 can be used to program dynamic interlocks that can help protect both equipment and crew.
*(** Don't drive while distracted or while using handheld devices. Use voice-operated systems when possible. Some features may be locked out while the vehicle is in gear. Not all features are compatible with all phones.)*

Vehicle Integration System 2.0 equipped F-150 Police Responder come from the factory ready to be upfit. This means no incremental hardware solutions from aftermarket suppliers, no more splicing into factory wiring harnesses, and no more running out of switches inside the cab. Instead, Vehicle Integration System 2.0 allows you to reduce the need to stock hardware while greatly expanding functionality.

Vehicle Integration System 2.0 Contents

Vehicles Built with Vehicle Integration System 2.0 Feature have the following functionality:

- Vehicle Integration System 2.0 is composed of: Pigtail Harness/Blunt Cut-Jumper, Vehicle Integration System 2.0 Module - J1939 Output Signals Access, and customer customizable Output/Input Signals.
- Programmability via the Ford Vehicle Integration System 2.0 Desktop Tool (https://www.fordpro.com/en-us/upfit/uis),
  - F-150 Police Responder will allow for customizable soft switches on the Sync screen.
- Vehicle Integration System 2.0 Module Pigtail Harness/Blunt Cut-Jumper Service Part Number: PC3Z-14A303-A (Ref. Engineering Part Number: PC3T-14A303-D*)

Vehicle Integration System 2.0 – Information & Support:

This UIS website https://www.fordpro.com/en-us/upfit/uis will provide information and support for fleet and upfitter communities with information about the Ford Vehicle Integration System 2.0. Below is a sampling of information that is available:

- *Vehicle Integration System 2.0 Logic Software*: Downloading the latest software version of the Ford Pro Vehicle Integration System 2.0to begin customizing your vehicles.
- *Add VINs*: Add VINs to deploy logic to vehicles. Once the VINs are added, the logic can be transferred to multiple vehicles.
- *Quick Start Guide*: Step-by-step guide to get you started with the logic software.

POLICE MODIFIER GUIDE

SECTION 2 – GENERAL ELECTRICAL INFORMATION

Vehicle Integration System 2.0 – Information & Support: (Cont'd)

- *Features & Signals:* An overview of features, different input, and output signals on the Vehicle Integration System 2.0 (including CAN), and a summary of the different types of logic blocks available. (J1939 CAN Read Signals, Logic Operators, SYNC Integration, and CAN write Signals)
- *Introductory Training:* A detailed guide for getting started. This includes an overview of the logic tool functionality and examples illustrating the creation of logic.
- *FAQs:* Hardware/Software/Network Requirements, Vehicle Cable Connectivity, etc.

Ford Pro Vehicle Integration System 2.0 Access:
To obtain access to the information shown above, the upfitter/final stage manufacturer will need to have a valid (approved) Fleet Identification Number (FIN) and username/password. ***If you are experiencing website Log/Sign-In issues OR need to validate and/or have questions about your upfitter FIN code please contact the Ford Pro Contact Center of Excellence (Ford Pro CCoE) at 1-800-34-FLEET (1-800-343-5338), Select 'Option 2'. This is a 24/7 Assistance Hotline.***
If you do not have a valid FIN, please contact 1-800-34-FLEET (1-800-343-5338).

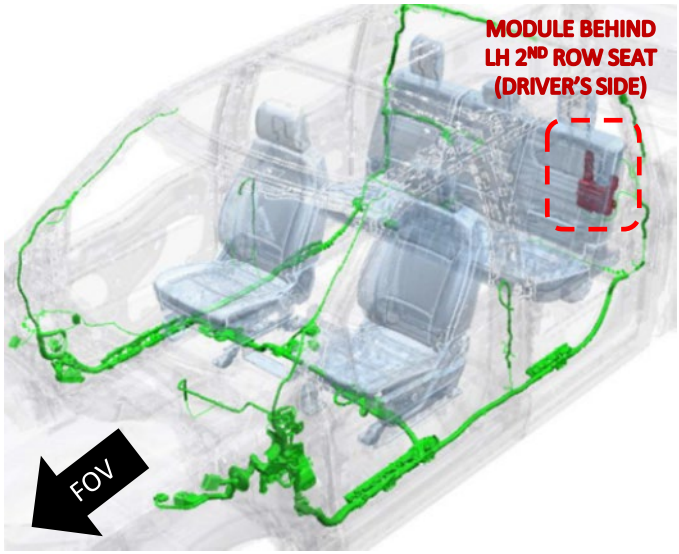
Electrical Overview:
IMPORTANT – F-150 Police Responder has a new electrical architecture and includes CAN encryption. The new electrical architecture will no longer use the Gateway Module/OBDII connector, instead it will have a central gateway module connecting all the networks and provide channels via the standalone OBDII connector for diagnostic commands. CAN networks are no longer available from the OBDII connector.

Vehicle Integration System 2.0 Module - Power On/Off Strategy:
Vehicle Integration System 2.0 Module is always powered during 'Key-On' and 'Accessory' modes – Module will be 'wakened' in a maximum of 5 seconds and/or 'asleep' in coordination with the vehicle network systems (approximately 5 – 10 minutes). In 'Key-Off' mode, the Module will not transmit any constant signal(s).

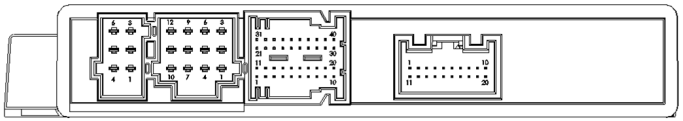
- WAKE FUNCTION: The 'wake' conditions are of two types:
  - a soft interruption (network management call from CAN) and
  - a circuit stimulation (any change of state inputs).
- ASLEEP FUNCTION: The trigger to go to sleep is based on the network management call from CAN network, this is dependent on conditions required for the module to sleep and/or 'Key-Off' mode.
-

Vehicle Integration System 2.0 MODULE - LOCATION: (Equipped From Factory)
Reference the following images on the location of the Vehicle Integration System 2.0 Module for F-150 Police Responder.

NOTE: Functionality will be provided via the Ford Provided pigtail harness/blunt cut-jumper.



Reference - Vehicle Integration System 2.0 Module - Connector View



Vehicle Integration System 2.0 Module - J1939 Output Signals:
Below is the list of currently available J1939.

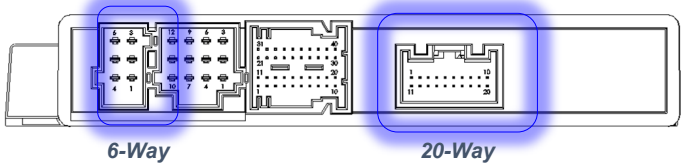
- ABS Active
- Ambient Air Temperature
- Air Conditioner Compressor
- Accelerator Pedal Position
- HVAC Recirculation Switch
- Battery Current
- Battery Voltage
- Battery Temperature
- Brake Switch
- Battery State Of Charge
- Cruise Control Mode
- Day Running Light
- Door 1 Status
- Hood Status
- Door 2 Status
- Door 3 Status
- Door 4 Status
- Door 5 Status
- MIL Lamp
- Emergency Light Siren
- Engine Status
- Engine Speed
- Engine Coolant Temperature
- Engine Oil Temperature
- Powertrain Status
- First Row Driver Buckle Status
- First Row Passenger Buckle Status
- Front Fog Light Status
- Rear Fog Light Status
- Fuel Level Percentage
- Oil Transmission Temperature
- Neutral Gear

Vehicle Integration System 2.0 Module - J1939 Output Signals: *(Cont'd)*

- Current Gear
- Select Gear
- Four Auxiliary Steering Wheel Switches
- (Police Interceptor Utility ONLY)
- Day
- Hours
- Minutes
- Seconds
- Year
- Headlamp Low Switch Status
- Headlamp High Switch Status
- Headlamp Light Switch Status
- Front Blower Speed
- Ignition Status
- Man Rgen Soot
- Max Defroster Switch Status
- Odometer Master Value
- Oil Pressure Warning
- Perimeter Alarm Status
- Park Brake Switch Status
- Park Brake Status
- Park Light Headlamp Status
- Regenerative Braking Status
- Second Row Passenger Buckle Status
- Second Row Driver Buckle Status
- Second Row Driver Middle Buckle Status
- Second Row Middle Buckle Status
- Second Tow Passenger Middle Buckle Status
- Steering Wheel Angle
- Stop Lamp Brake Request
- Third Row Driver Buckle Status
- Third Row Middle Buckle Status
- Third Row Passenger Buckle Status
- Tire Pressure
- Park System
- Left Turn Light Status
- Right Turn Light Status
- Hazard Light Switch Status
- Police Idle Status
- Vehicle Inhibit Motion
- Auxiliary Digital Input 1 Status
- Auxiliary Digital Input 2 Status
- Auxiliary Digital Input 3 Status
- Auxiliary Digital Input 4 Status
- Auxiliary Digital Input 5 Status
- Auxiliary Digital Input 6 Status
- Auxiliary Digital Input 7 Status
- Auxiliary Digital Input 8 Status
- Auxiliary Digital Input 9 Status
- Auxiliary Digital Input 10 Status
- Auxiliary Digital Input 11 Status
- Auxiliary Digital Input 12 Status
- Auxiliary Digital Input 13 Status
- Auxiliary Digital Input 14 Status
- Auxiliary Digital Input 15 Status
- Auxiliary Digital Input 16 Status
- Auxiliary Digital Output 1 Status
- Auxiliary Digital Output 2 Status
- Auxiliary Digital Output 3 Status
- Auxiliary Digital Output 4 Status
- Auxiliary Digital Output 5 Status
- Auxiliary Digital Output 6 Status
- Auxiliary Digital Output 7 Status
- Auxiliary Digital Output 8 Status
- Automatic Engine Idle Shutdown Override
- Wheel Based Vehicle Speed
- Vehicle Identification Number
- Acceleration Rate
- Long Rate
- Roll Rate
- Vertical Rate
- Yaw Rate
- Front Wiper Switch Status

Vehicle Integration System 2.0 Module - J1939 Output Customer Can-signal Access:

Module Connector View

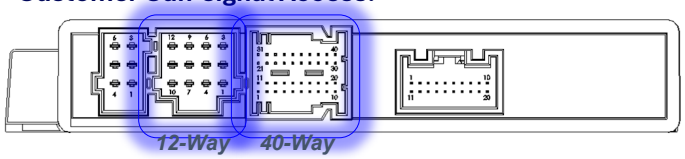


1. Vehicle Integration System 2.0 Module Location: (Reference images on previous page)
   a. F-150 Police Responder – LH Behind 2nd Row Seat (Driver's Side)
2. Disconnect both the Black 20-Way and Blue 6-Way from the module to ensure no power is being delivered to module. (Reference respective Police Modifier Guides for circuits/pin-outs details.)
3. The Black 20-Way circuits will be used to access the J1939 signals. Focusing on the Black 20-Way connector, carefully begin to unravel/unwrap the flocked tape around the harness such that enough workable length is available to expose the wire circuits. Stow away the unraveled/unwrapped flock tape so it can be reused for re-installation later.
4. Locate the J1939 wired circuits 3 & 4 (wire 3 CAN ' + ' GN/BU & wire 4 CAN ' – ' GY/BU). These 2 circuits will be used in order to perform the cut and splice to obtain the signals.
   NOTE: The circuits remaining in the harness will not be used and no longer need to be connected. Recommend taping the circuits back securely and stowed away from the splice.
   NOTE: Follow the Ford approved procedure for soldering circuits to complete the splice. These are CAN network circuits that are a twisted pair, and for the added length ensure it meets the twists per foot requirement (4 twists per 50mm)
5. Complete the splice, following the Ford Repair Guidelines, rewrap the flock tape removed (Step 4) or use an acceptable substitute ensuring that circuits are wrapped within 50mm from the back of the connector.

Vehicle Integration System 2.0 Module - J1939 Output Customer Can-signal Access: *(Cont'd)*

6. Reconnect the Black 20-way, and Blue 6-way to the Module
7. Reinstall the Vehicle Integration System 2.0 Module, and glove compartment following the reinstallation procedure outlined by Motorcraft Service, www.motorcraftservice.com .

Vehicle Integration System 2.0 Module - Output Customer Can-signal Access:



The following UIS sample list of Channel/Signal Outputs for the 40-Way and 12-Way.

40-WAY PINOUT (PU5T-14489 MA)

Cavity	Circuit	Color	Alt. Name	Signal Name	Description
1	CAC37A	YE/GN	LSD 1	MFA_15	LS Switch Output 0.5A, PWM
2	CAC39A	YE/VT	LSD 2	MFA_16	LS Switch Output 0.5A, PWM
3	CAC41A	GY/BN	LSD 3	MFA_13	LS Switch Output 1A, PWM
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	CAC20A	BU/GN	DAH 1	MFE_17	Digital Input, high active
8	CAC22A	GN/WH	DAH 2	MFE_19	Digital Input, high active
9	CAC24A	BU/GY	DAH 3	MFE_21	Digital Input, high active
10	CAC26A	GN/VT	DAH 4	MFE_23	Digital Input, high active
11	CAC43A	VT/GY	LSD 4	MFA_17	LS Switch Output 0.5A, PWM
12	CAC45A	WH/VT	LSD 5	MFA_18	LS Switch Output 0.5A, PWM
13	CAC47A	VT/OG	LSD 6	MFA_14	LS Switch Output 1A, PWM
14	-	-	-	-	-
15	-	-	-	-	-
16	-	-	-	-	-
17	CAC28A	BU/BN	DAH 5	MFE_18	Digital Input, high active
18	CAC30A	YE/BU	DAH 6	MFE_20	Digital Input, high active
19	CAC32A	GN/OG	DAH 7	MFE_22	Digital Input, high active
20	CAC34A	GN	DAH 8	MFE_24	Digital Input, high active
21	CAC54A	BN/GN	HSD 10	MFA_11	HS Switch Output 0.5A, PWM, Supply_2
22	CAC68A	BN/YE	HSD11	MFA_12	HS Switch Output 0.5A, PWM, Supply_2
23	CAC19A	BU	DAL 1	MFE_9	Digital Input, low active
24	CAC21A	GY	DAL 2	MFE_11	Digital Input, low active
25	CAC23A	GY/YE	DAL 3	MFE_13	Digital Input, low active
26	CAC25A	VT/WH	DAL 4	MFE_15	Digital Input, low active
27	VAC01A	WH/BN	ANL IN 1	MFE_1	Analog Input
28	VAC02A	GY/OG	ANL IN 2	MFE_3	Analog Input
29	VAC03A	WH/OG	ANL IN 3	MFE_5	Analog Input
30	VAC04A	YE	ANL IN 4	MFE_7	Analog Input
31	CAC69A	BU/GN	HSD 12	MFA_9	HS Switch Output 0.5A, PWM, Supply_1
32	CAC70A	VT/GN	HSD 13	MFA_10	HS Switch Output 0.5A, PWM, Supply_1
33	CAC27A	WH/GN	DAL 5	MFE_10	Digital Input, low active
34	CAC29A	GY/VT	DAL 6	MFE_12	Digital Input, low active
35	CAC31A	VT/BN	DAL 7	MFE_14	Digital Input, low active
36	CAC33A	GY/BU	DAL 8	MFE_16	Digital Input, low active
37	VAC05A	GN/BN	ANL IN 5	MFE_2	Analog Input
38	VAC06A	YE/VT	ANL IN 6	MFE_4	Analog Input
39	VAC07A	BN/BU	ANL IN 7	MFE_6	Analog Input
40	VAC08A	YE/OG	ANL IN 8	MFE_8	Analog Input

12-WAY PINOUT (PU5T-14489-LA)

Cavity	Circuit	Color		Signal Name	Description
1	CAC38A	BU/BN		MFA_7	HS Switch Output 5A, Supply_2
2	CAC40A	BN/GN		MFA_5	HS Switch Output 5A, Supply_1
3	CAC42A	WH/BN		MFA_6	HS Switch Output 5A, Supply_1
4	CAC44A	WH/OG		MFA_8	HS Switch Output 5A,Supply_2
5	CAC46A	GY/OG		MFA_4	HS Switch Output 10A, Supply_2
6	CAC48A	WH/GN		MFA_1	HS Switch Output 5A, Supply_1
7	CAC50A	VT/GN		MFA_3	HS Switch Output 5A, Supply_2
8	WAC64A	BU		MFA_20	HB_1 Output 5A, Supply_1
9	WAC65A	YE/GY		MFA_19	HB_1 Output 5A, Supply_1
10	WAC66A	VT/BN		MFA_22	HB_2 Output 5A, Supply_2
11	WAC67A	GN/VT		MFA_21	HB_2 Output 5A, Supply_2
12	CAC51A	BU/OG		MFA_2	HS Switch Output 10A, Supply_1

For every input into Vehicle Integration System 2.0 Module, the voltage range must be within the recommend minimum and maximum range, refer to the Ford Pro™ | Commercial Fleet Vehicles, Services & Telematics website, https://www.fordpro.com/en-us/upfit/uis .

For every Pulse Width Modulation (PWM), the maximum and minimum frequencies should be within the recommended high and low amperage outputs, refer to the Ford Pro website, https://www.fordpro.com/en-us/upfit/uis .

NOTE: UIS Grounding - recommendation is that the UIS must be grounded up to 40 Amps, and additional grounds to be routed/connected to chassis/frame. IT IS ***NOT RECOMMENDED TO UTILIZE EXISTING OEM GROUNDS***, follow recommended grounding guidelines in General Body Builder Layout Book or www.motorcraftservice.com).

NOTE: During vehicle cranking and/or stop-start function, the voltage may drop below 9-Volts, 1. Vehicle Integration System 2.0 Feature will momentarily become interrupted (pause in functionality), until the voltage is recovered, and Vehicle Integration System 2.0 Feature will resume.

MOBILE RADIO INSTALLATION GUIDELINES

NOTICE: This information has been prepared for use by persons installing 2-way radio equipment (transmitters and receivers) in vehicles. It has been prepared in accordance with current engineering principles and generally accepted practices, using the best information available at the time of publication. These guidelines are intended to supplement, but not to be used in place of detailed instructions for such installations which are the sole responsibility of the manufacturer of the land mobile radio. Since it is not possible to cover all possible installations of 2-way radio equipment, Ford Motor Company cannot be held responsible for incidental or consequential damages arising from the use of the information contained herein. Certain land mobile radios or the way in which they are installed may affect the vehicle operations such as the performance of the engine and driver information, entertainment and electrical charging systems. Expenses incurred to protect the vehicle systems from any adverse effect of any such installation are not the responsibility of Ford Motor Company.

General Information

Ford Motor Company vehicles are designed and tested for safe operation with correctly installed and used land mobile/amateur radio communication equipment with up to 100-watt transmitter power.
Special design considerations are incorporated into all Ford vehicle electronic systems to provide immunity to radio frequency signals. To maintain compatibility with vehicle electronic systems, mobile 2-way radio and telephone equipment must be installed correctly by trained personnel, observing these general guidelines:

- Power connections should be made directly to the battery and fused as close to the battery as possible. Avoid using cigar lighter or power point receptacles as power sources for radio communication equipment.
- Antennas for 2-way radios should be mounted on the roof or the rear area of the vehicle. Care should be used in mounting antennas with magnet bases, since magnets may affect the accuracy or operation of the compass on vehicles, if so equipped.
- The antenna cable should be high quality, fully shielded coaxial cable, and kept as short as practical. Avoid routing the antenna cable in parallel with vehicle wiring over long distances.
- Carefully match the antenna and cable to the radio to achieve a low Standing Wave Ratio (SWR) and to avoid radio frequency currents on the antenna cable shield.

Check installations for possible interference between the communications equipment and vehicle electronics. Mobile radio equipment with greater than 100 watts output may require special precautionary measures beyond those outlined in this document.

This Guide is a supplement to the radio manufacturer's installation instructions for installing communication equipment in Ford vehicles. Additional sources of information are listed on page 3-4.

Radio transmitters are regulated by the Federal Communications Commission (FCC) in the United States. Compliance with FCC regulations is the responsibility of the manufacturer and/or user of transmitter equipment and not Ford Motor Company.

Installation Guidelines

WARNING: Do not mount any transceiver, microphones, speakers or any other item in the deployment path of the airbag system. Failure to follow these instructions may result in personal injury.

Transceiver Location

Select a transceiver location that provides a solid mounting point, does not interfere with the vehicle operator controls and provides adequate ventilation.

Before using screws to mount the transceiver equipment, be sure to check for vehicle wiring under the carpet or behind the instrument panel which could be pinched, cut or otherwise damaged.

Radio Wiring and Routing

Make transceiver power connections directly to the battery and appropriately fused as close to the battery as possible. A weatherproof fuse holder is recommended. Twist the positive and negative power leads together to enhance noise immunity.

Use caution when routing wires between the passenger and engine compartments to avoid chafing or pinching of wires. Use grommets over any exposed sharp edges and strain reliefs to keep wires in place. Seal all holes to prevent moisture intrusion.

Route and secure all underhood wiring away from mechanical hazards such as exhaust manifolds steering shaft, throttle linkage, and fans. Maintain as much distance as possible between mobile radio power leads and the vehicle's electronic modules and wiring. Avoid running power leads in parallel with vehicle wiring over long distances.

NOTE: On some Ford vehicles the rear window contains the entertainment radio antennas (AM and FM). Avoid using the rear window to mount mobile radio antennas in these vehicles.

Antenna Location and Installation

Permanently installed antennas are preferable over magnetic, glass or body lip mounts for anything other than for low power or temporary installations. Most of these alternate antennas can reflect significant power back at the feed point; this reflected power could then radiate from the feedline inside the passenger compartment and be picked up by the vehicle wiring. However, a magnetic-mount antenna is a good tool for checking the proposed fixed antenna location for unwanted effects on the vehicle since antenna location is a major factor in these effects.

POLICE MODIFIER GUIDE

SECTION 3 - INSTALLATION CONSIDERATIONS

Antenna Location and Installation *(Cont'd)*

Glass-mounted antennas should be kept as high as possible in the center of the rear window or windshield. Some vehicles use glass that contains a thin metallic coating for defrosting or to control solar gain; glass mount antennas may NOT function correctly when mounted on this type of glass. (Ford Privacy Glass contains such a coating.) Also, refer to the antenna manufacturer's recommendations.

If a magnetic mount antenna is used, take care to locate the magnetic base in a location which avoids interference to the vehicle's compass mechanism, if so equipped. Also, some Ford vehicles use non-metallic body panels (decklids, etc.). If metallic backing panels are used, do not block the reception paths for factory installed antennas, such as Global Position Satellite (GPS) transceivers, if so equipped.

NOTE: To maintain proper operation, periodically check the antenna installation for correct SWR and any signs of damage or deterioration.

Antenna Tuning: It is important the antenna be tuned correctly and reflected power be kept to less than 10% (VSWR less than 2:1).

Antenna Cable Routing

Always use a high-quality, 1-piece coaxial cable (at least 95% shield coverage). Connector quality and termination techniques are just as important. The ARRL handbook provides excellent guidelines for terminating coaxial cables.

Treat antenna cable in the same way as the control and power cables. Avoid sharp edges and pinches and keep the cable as short as possible. Also, avoid routing the antenna cable in parallel with vehicle wiring over long distances it is necessary to cross over wiring cross at right angles. In some cases, additional shielding between the antenna cable and the vehicle wiring may be helpful.

Additional Information

Troubleshooting - Should vehicle-radio interaction develop following installation; the source of the problem should be identified prior to further operation of the vehicle. Most interaction problems can be eliminated by following these installation guidelines.

Possible causes of vehicle-radio interaction include:

- Antenna location (move antenna to another position)
- Antenna feed line routing (locate as far as possible from vehicle electronics and wiring)
- Inadequate shielding or loose/corroded connectors associated with the antenna feed line.
- Mismatched antenna or high SWR
- Power feeds not connected directly to the vehicle battery.
- Power feed routing (locate as far as possible from vehicle electronics and wiring)

If any vehicle radio interaction problems exist after following these guidelines, contact the radio equipment manufacturer for additional assistance.

Additional Sources of Information

Radio Frequency Interference: How to Find It and Fix It ISBN: 0-87259-375-4, The American Radio Relay League, Inc. Newington, Connecticut 06111-1494, Phone 203-666-1541 / Fax 203-665-7531

Giving 2-Way Radio Its Voice (booklet) Champion Spark Plug Company, Automotive Technical Services Dept., P.O. Box 910, Toledo, Ohio 43661

PUSH BUMPERS

Effect On Air Bag Deployment

Different push bumper designs have different deformation characteristics in a crash situation that may or may not affect the deployment of air bags. Without the benefit of crash tests on vehicles equipped with push bumpers (there are a number of different styles available), it is the opinion of Ford Motor Company that installation of some push bumpers could affect the timing of the air bag deployment.

Effect On Weight Distribution

The balance and weight distribution of a vehicle is carefully planned to achieve optimal stability and handling. Push bumpers can change this weight distribution by adding excessive weight to the front of the vehicle. There are many different styles of push bumpers available.

Depending on the mounting and weight of the push bumper to be installed, it could have an adverse effect on the handling of a vehicle. Always verify the vehicle ride height after the adding a push bumper. For additional information, refer to Section 1: General Information in this guide. Adjust the ride height if the measurements are not within specifications.

Airflow

The engine cooling system on a vehicle relies on correct airflow through the radiator to keep the engine at its correct operating temperature. When adding a push bumper to a vehicle, make sure this airflow is not obstructed, especially when lights and sirens are mounted on the push bumper. Reduced airflow could put additional strain on the cooling system and shorten the operational life of related components. During the installation process, keep the placement of components away from the grille area of the vehicle.

SIREN AND GRILLE LIGHTS

The engine cooling system relies on correct airflow through the radiator to keep the engine at its correct operating temperature. When adding sirens and grille lights to a vehicle, make sure this airflow is not obstructed. Reduced airflow could put additional strain on the cooling system and shorten the operational life of related components. During the installation process, keep the placement of components away from the grille area of the vehicle.

POLICE MODIFIER GUIDE

SECTION 3 - INSTALLATION CONSIDERATIONS

INTERIOR EQUIPMENT MOUNTING

Mounting of equipment should be accomplished by attaching to sheet metal or other structural points that will maintain its integrity during an impact and/or useful life during police use.

WARNING: Interior trim panels should not be used for mounting police equipment.

PARTITION INSTALLATION GUIDELINES

WARNING: Side curtain deployment drawing are shown in Section 5: Reference Information. Review the deployment drawings before installing a partition or other equipment to make sure that there is no deployment interference. Failure to follow these instructions may result in personal injury.
WARNING: The partition and the installation hardware of the partition must not interfere with the correct operation of the safety belt, safety belt retractor, side impact sensor and the safety belt height adjusters. Failure to follow these instructions may result in personal injury.
WARNING: Installation of prisoner partitions may increase the risk of injury to front seat occupants if the vehicle is impacted from a high-speed rear-end collision. This risk should be balanced by the law enforcement agency against the risk of injury to the officer associated with prisoner transportation. Failure to follow these instructions may result in personal injury.

VEHICLE DESIGN AND COMPONENT LOCATION

Restraint system component location, airbag location and airbag deployment drawings are provided in Section 5: Reference Information. Consult the drawings before equipment is installed inside the passenger compartment to make sure that the mounted equipment does not interfere with restraint and/or airbag deployment.

Safety Belt Retractor and Side Impact Sensor

The front safety belt retractors are located in the base of the B-pillars. The pretensioner located in the buckle is referred to as the safety belt buckle pretensioner. In the event of an air bag deployment, pretensioners provide improved occupant protection by rapidly removing slack from the safety belt. Removing slack from the safety belt helps to correctly position the occupant and allows for maximum effectiveness of the safety belts and the air bags.

- Do not use the safety belt retractor bolts for mounting the partition.
- Do not mount any partition hardware on the B-pillar.
- Do not mount any partition hardware that will interfere with the correct sealing of the door.

WARNING: The front side impact sensors are located in the front doors. These are pressure sensors that measure the pressure change in the front door during an impact. Do not mount anything on or in the door. Do not cut any holes in the door sheet metal, trim or water seals. Failure to follow this instruction may cause personal injury.

Restraints Control Module (RCM)

WARNING: Do not relocate the Restraints Control Module (RCM) or modify its installation in any way. Failure to follow these instructions may result in personal injury.

The RCM is mounted on the center tunnel under the carpet (under the first-row bench seat if equipped). The RCM orientation is critical for correct operation of the restraint systems. Do not use the RCM mounting bolts as attachment points for equipment.
Air Bag Deployment Interference

WARNING: Side curtain deployment drawing are shown in Section 5: Reference Information. Review the deployment drawings before installing a partition or other equipment to make sure that there is no deployment interference. Failure to follow these instructions may result in personal injury.

WARNING: Do not place objects or mount equipment in front of the air bag module cover or in front seat areas that may come in contact with a deploying air bag. Dash, tunnel or console-mounted equipment should be placed within the specified zone. Dash, tunnel or console-mounted equipment should not be placed outside of the specified zone. Failure to follow these instructions may result in personal injury.

WARNING: Do not mount equipment between the side of the front seat and the door trim that would block deployment of the side air bag. Failure to follow these instructions may result in personal injury.

Driver/passenger air bags affect the way police equipment can be mounted in police vehicles. Any surfaces that could come into contact with an air bag during deployment must not damage the air bag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon air bag material and reduce the effectiveness of the air bag. Do not mount or place any objects in the deployment path of an air bag. Air bags must be allowed to fully deploy without restriction. The deployment of air bags is not compatible with any configuration of police equipment mounting that places objects in the air bag deployment path. Equipment mounted or placed in the deployment area of an air bag will reduce the effectiveness of the air bag, damage the air bag and potentially damage or dislodge the equipment.

Seat Bolts

NOTICE: Do not install longer seat bolts if reinstalling seats.
The vehicle safety belts, and seat assemblies are factory installed in their correct location. Seat attaching bolts are not to be used as attachment points for any equipment. Any added material between the seat bolt and the seat frame could have unpredictable effects on the seat bolt torque.

Seat Bolts *(Cont'd)*

If the safety belts are removed for any reason, all of the appropriate attaching hardware must be hand started and then tightened to the correct torque specifications as per the workshop manual. Correct operation must be verified before returning the vehicle to service.
NOTE: Workshop manual should be reviewed for seat bolt replacement direction when seat(s) are removed and replaced/reinstalled.

Driveshaft Clearance
When installing police equipment such as a console or other equipment in the console area, it is important to consider the available clearance between the underbody and the driveshaft. Never use self-tapping screws and never use screws that are longer than necessary in the console area.

Brake Line Clearance
When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.

Battery Saver
NOTE: Time-out is 10 seconds if the vehicle is in factory mode or 1 minute if the vehicle is in transport mode.

NOTE: The battery saver does not control the parking lamps if the headlamp switch is in the PARKING LAMPS ON position

The BCM provides automatic shut-off of the courtesy and demand lamps after a time-out period when the ignition is OFF. A timer in the BCM starts when:
- the ignition transitions to OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of a remote keyless entry (RKE) transmitter is pressed.
- a door is unlocked using the passive entry feature.
- a valid code was entered on the keyless entry keypad.

When 10 minutes (30 minutes for demand lamps) have elapsed, the BCM automatically shuts off voltage to the lamps. The timer restarts (voltage is restored if the BCM is in battery saver mode) when:
- the ignition transitions out of OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of the RKE transmitter is pressed.
- a door is unlocked using the passive entry feature.
- a valid code was entered on the keyless entry keypad.

CARGO MOUNTING CONSIDERATIONS

Cargo Area Equipment Mounting Guide

NOTICE: When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.

NOTICE: Inspect behind trim and under the vehicle when determining mounting locations. Be sure the drill/fasteners will not puncture/touch and will leave adequate clearance from the fuel tank, fuel lines, brake lines, wiring harnesses, evaporative emissions (EVAP) canister and the fuel pump shut-off switch as well as other vehicle systems. Refer to Section 5: Reference Information in this guide for additional illustrations showing the location of the fuel tank, fuel lines, brake lines and the fuel pump shut-off switch. Damage to vehicle components may occur.

Be aware of the following component locations when mounting equipment in the cargo area:

- Fuel tank
- Fuel lines
- Brake lines
- Evaporative emissions (EVAP) canister
- Electronic modules
- Wiring harnesses
- Spare tire

Cargo Loading

WARNING: Ford recommends that police equipment be both secured and laterally aligned. Hard, stiff or sharp objects, especially when not secured or correctly located, pose a risk to the occupants. Aftermarket organizers that do not adequately deform in rear-impacts can themselves become injury-producing objects. Failure to follow these instructions may result in personal injury.

An acronym has been developed to increase police agency awareness of the importance of cargo packing. Improve police officer safety by implementing a cargo-packing process called "LOAD SAFE".

LOAD	SAFE
LATERAL ORIENTATION AND DIRECTION	SOFT AND FIXED EQUIPMENT

Equipment Categories and Placement

WARNING: Gasoline should not be stored in the occupant area at any time, regardless of container. Failure to follow this instruction may result in personal injury.

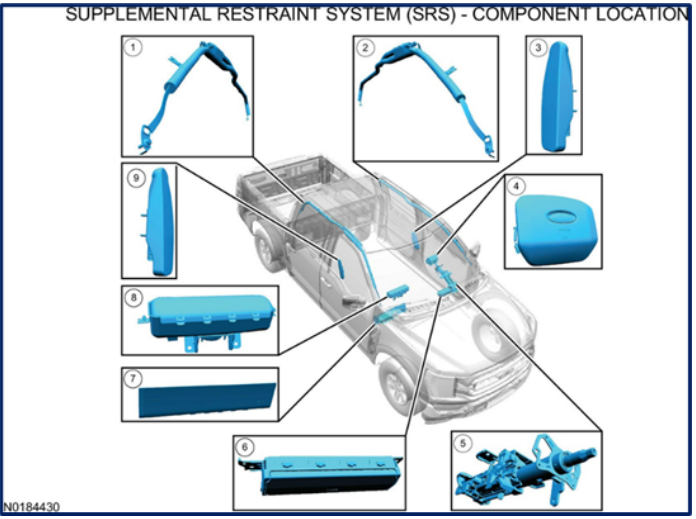
It is recognized that a wide variety of equipment is carried in police vehicles as noted above. This section addresses the inherent risks of various types of equipment in the event of a high-speed rear impact.

- ***Carrying Not Recommended*** —The following items have been observed in police vehicles and should not be transported in the vehicle occupant area: containers with gasoline, loose ammunition, loose flares, loose fire extinguisher(s), loose 4-point lug wrenches, loose crowbars, loose axes and other loose equipment with potential injury capability in collisions.
- ***Carry With Caution*** —These items will require special packing or mounting consideration. Examples include (with proposed orientation): fire extinguisher (fixed), lug wrench 4-point (fixed, vertical), Rolo tape measuring wheel (fixed, vertical), safety flares (lateral orientation, in a container), stop stick (lateral), shovel (lateral, place at rear of cargo area), shotgun and rifle (lateral, store in case), baton (lateral, place at rear of cargo area), electronic equipment and ammunition (container). Flares should be placed in a protective storage container (preferably soft-sided plastic). Flares with spikes attached should be laterally oriented in the cargo area.
- ***Low Risk Items*** — These items are soft in feel and pose a low risk of potential injury capability in collisions. Examples are: a soft camera case, biohazard kit in plastic boxes, gloves, safety rope, tow strap, traffic cones and sleeves, rain gear, riot gear (soft), emergency blankets, bullet-resistant vests, tie straps, cloth tape, garment bags, first responder kit, Res-Q-Flo masks (placed in garment bag), fuses (plastic container), briefcases, notebooks, spray bottles, soft helmets and jumper cables.

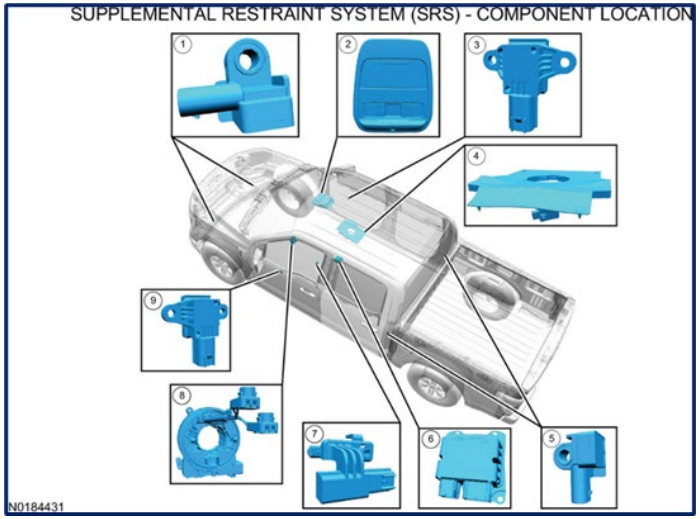
Cargo Area Weight

The vehicle's high-speed handling and curb height becomes increasingly affected as weight is added to the cargo area. The more weight that is placed in the cargo area, the more it changes the ride and handling characteristics of the vehicle. Consider these factors when installing equipment and placing items in the cargo area of the vehicle.

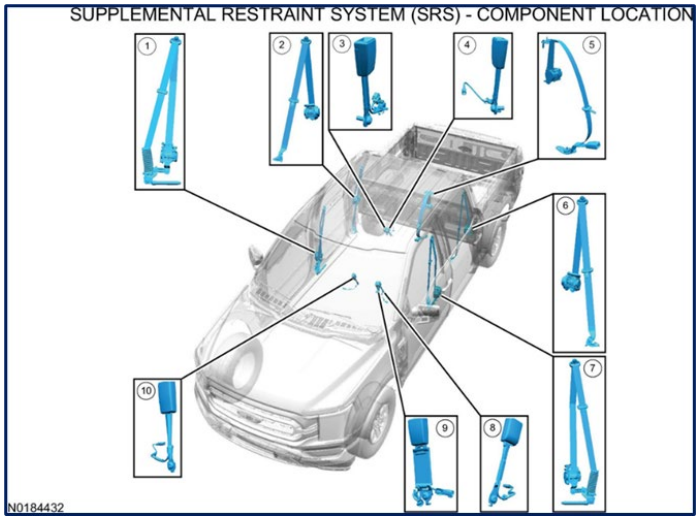
SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENT LOCATION



1. Passenger Side Curtain Airbag
2. Driver Side Curtain Airbag
3. Driver Side Airbag
4. Driver Airbag
5. Adaptive Energy Absorption Steering Column
6. Driver Knee Airbag
7. Passenger Knee Airbag
8. Passenger Airbag (Includes Canister Vent)
9. Passenger Side Airbag



1. Driver And Passenger Front Impact Severity Sensors
2. Overhead Console (Includes Pad Indicator)
3. Passenger Front Door Side Impact Sensor
4. OCSM (Includes OCS Sensor And Gel-filled Bladder)
5. Driver And Passenger B-pillar Side Impact Sensors (Super Cab) / Driver And Passenger C-pillar Side Impact Sensors (Super Crew)
6. RCM
7. Driver Seat Position Sensor
8. Clock spring
9. Driver Front Door Side Impact Sensor



1. Front Passenger Seatbelt Retractor And Pretensioner (Includes Retractor Load Limiter And Anchor Pretensioner) (Super Crew Shown, Other Body Styles Similar)
2. Passenger Rear Outer Seatbelt Retractor And Pretensioner (Super Crew Shown, Super Cab Similar)
3. Passenger Rear Outer Seatbelt Buckle Assembly (Includes Seatbelt Buckle Switch) (Super Crew Shown, Super Cab Similar)
4. Rear Center Seatbelt Buckle Assembly (Includes Seatbelt Buckle Switch) (Super Crew Shown, Super Cab Similar)
5. Driver Rear Seatbelt Buckle (Includes Seatbelt Buckle Switch) (Part Of The Rear Center Seatbelt Retractor) (Super Crew Shown, Super Cab Similar)
6. Driver Rear Outer Seatbelt Retractor And Pretensioner (Super Crew Shown, Super Cab Similar)
7. Driver Seatbelt Retractor And Pretensioner (Includes Retractor Load Limiter And Anchor Pretensioner) (Super Crew Shown, Other Body Styles Similar)
8. Driver Seatbelt Buckle (Includes Seatbelt Buckle Switch)
9. Front Center Seatbelt Buckle (Includes Seatbelt Buckle Switch) (If Equipped)
10. Front Passenger Seatbelt Buckle (Includes Seatbelt Buckle Switch And Belt Tension Sensor [BTS])

ENGINEERING DRAWINGS

Airbag Deployment Interference

WARNING: Do not place objects or mount equipment in front of the airbag module cover or in front seat areas that may come in contact with a deploying airbag, dash, tunnel or console-mounted equipment should be placed within the specified zone. Failure to follow these instructions may result in personal injury.

WARNING: Dash, tunnel or console-mounted equipment should not be placed outside of the specified zone. Failure to follow these instructions may result in personal injury.

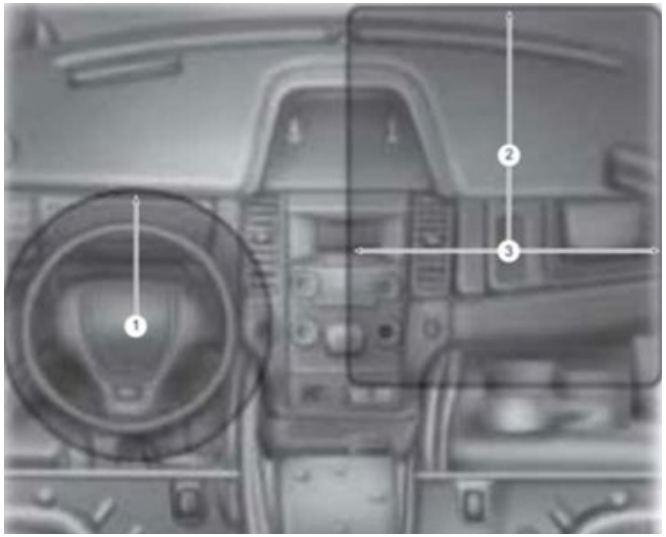
WARNING: Do not mount equipment between the side of the front seat to the door trim that would block deployment of the side airbag. Failure to follow these instructions may result in personal injury.

Driver/passenger airbags affect the way equipment can be mounted in vehicles. Any surfaces that could come into contact with an airbag during deployment must not damage the airbag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon airbag material and reduce the effectiveness of the airbag. Do not mount or place any objects in the deployment path of an airbag. airbags must be allowed to fully deploy without restriction. The deployment of airbags is not compatible with any configuration of police equipment mounting that places objects in the airbag deployment path. Equipment mounted or placed in the deployment area of an airbag will reduce the effectiveness of the airbag, damage the airbag and potentially damage or dislodge the equipment.

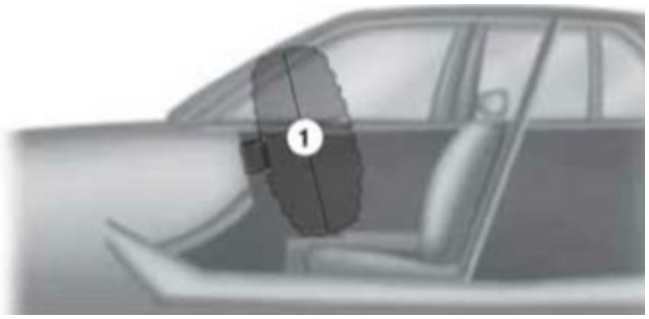
Some approximate dimensions for airbags, at full inflation, are provided in Figures 1 through 4. These dimensions are somewhat flexible and represent free-form deployments without the loading of occupants.

All airbag and equipment mounting zone dimensions are approximate due to different airbag deployment characteristics.

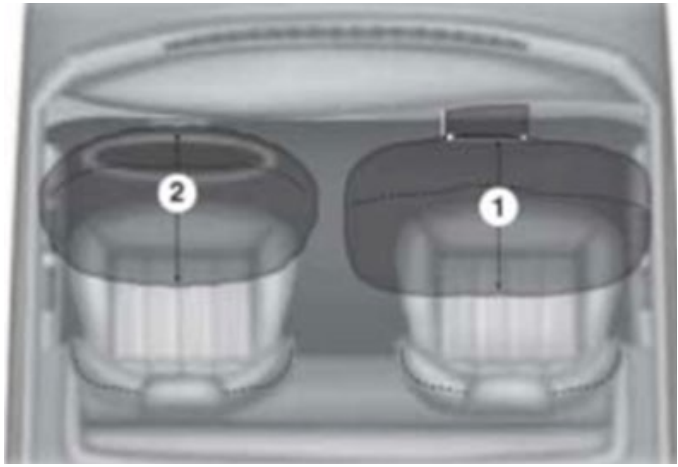
Mount no equipment between the side of the front seat and the door trim that would block deployment of the side airbag.



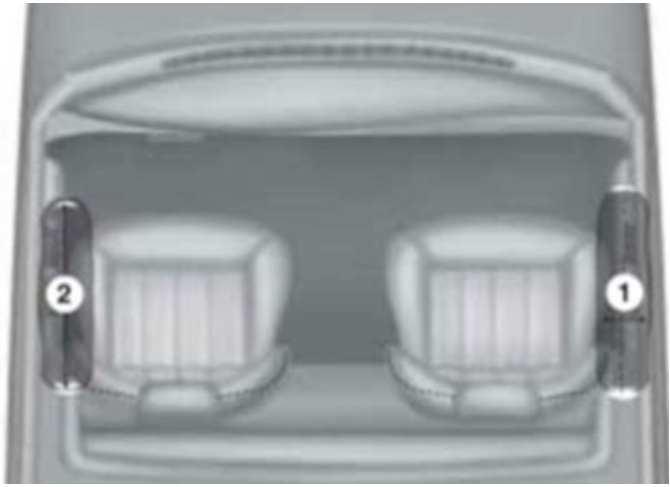
1. From the center of steering wheel emblem. 14 inches (356 mm)
2. From the center of the passenger airbag door. 14.2 inches (361 mm)
3. No objects should be placed between the airbags due to airbag variability. 30.5 inches (775 mm)



1. 39.9 inches (1014 mm)

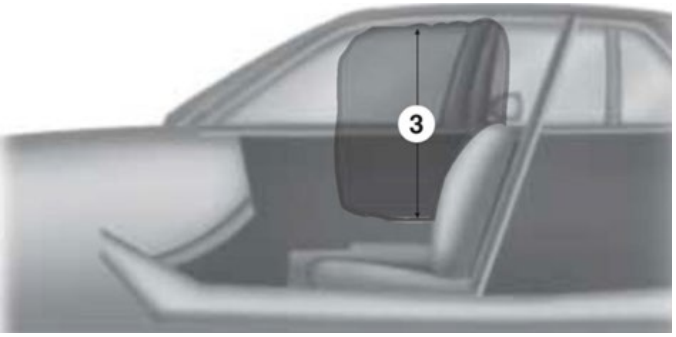


1. Front Passenger airbag 37.5 inches (953 mm)
2. Front driver 18 inches (458 mm)

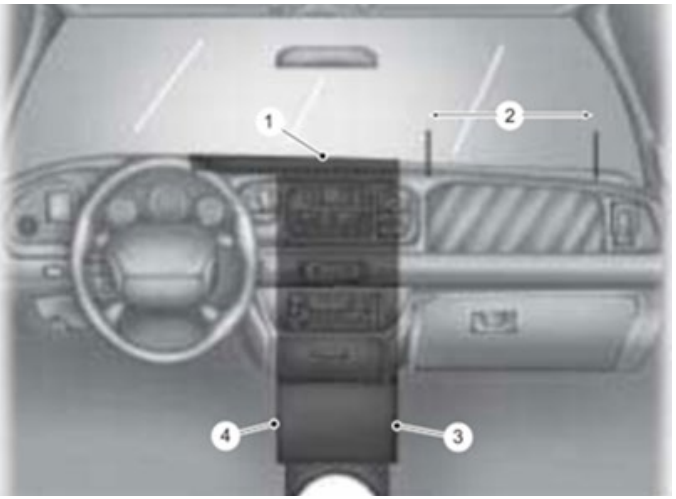


1. From the outboard side of seat 6.02 inches (153 mm)
2. Forward of seat back 14 inches (356 mm)

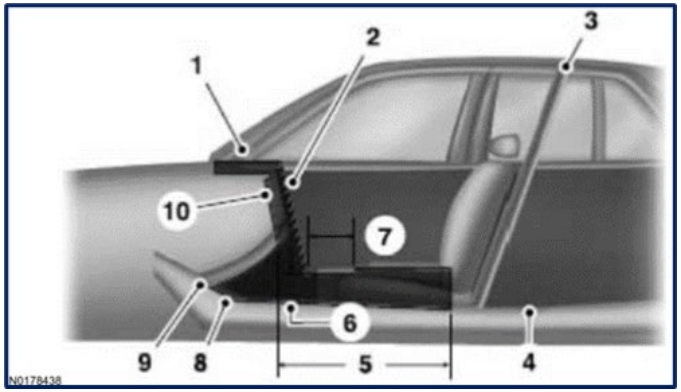
Airbag Deployment Interference *(Cont'd)*



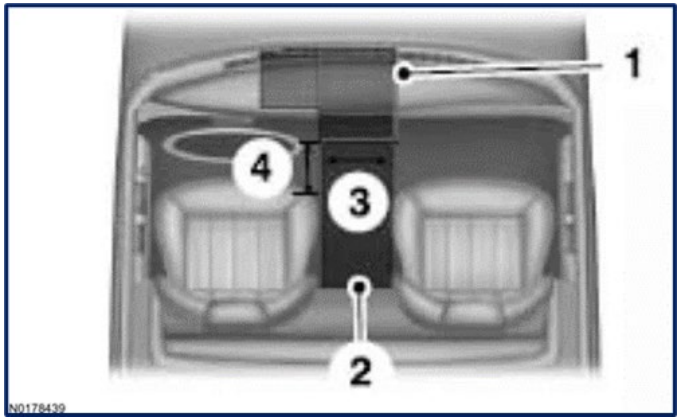
3. 39.9 inches (1014 mm)



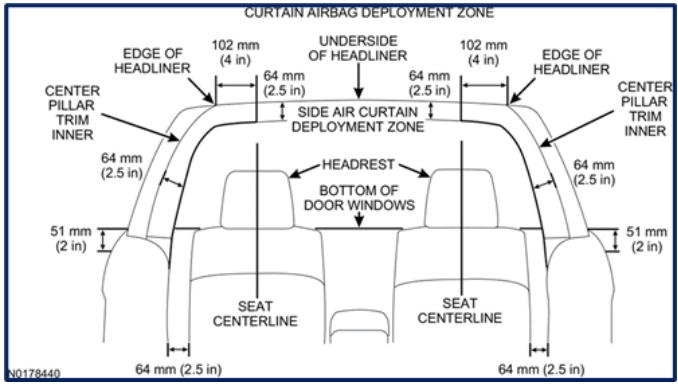
1. Area on top of instrument panel. Equipment must not interfere with the driver's visibility.
2. Airbag door must be kept clear for deployment of airbag.
3. Area in front of electronic finish panel from the bottom of the ashtray to the top of the instrument panel passenger side.
4. Area in front of electronic finish panel from the bottom of the ashtray to the top of the instrument panel driver's side.



1. Area on top of instrument panel
2. Area in front of center console from tunnel to instrument panel
3. Prisoner screen
4. 11 inches (279 mm)
5. Area on tunnel between seats
6. Height: 9.5 inches (241 mm)
7. 13 inches (330 mm)
8. Area on tunnel beneath center console
9. Tunnel
10. Depth: 2.5 inches (64 mm)



1. Area on top of instrument panel. Equipment must not interfere with driver visibility
2. Area on tunnel between seats
3. 10 inches (305 mm)



WARNING: The front side impact sensors are located in the front doors. These are pressure sensors that measure the pressure change in the front door during an impact. Do not mount anything on or in the door. Do not cut any holes in the door sheet metal, trim or water seals. Failure to follow these instructions may result in personal injury.

WARNING: The rear side impact sensors are located in the C-pillars. The installation of hardware must not interfere with the correct operation of the rear side impact sensors. Failure to follow these instructions may result in personal injury.

The curtain airbag extends from the A-pillar to the C-pillar and from the roof rail to the beltline.

- Do not mount equipment to the B, and C-pillars above the beltline.
- Do not mount equipment to the A-pillar above the beltline except for spotlights.
- Do not mount equipment on the headliner within 200 mm (8 in) of the side edges.
- Do not mount equipment above the beltline within 200 mm (8 in) of the side glass from the A-pillar leading edge to the rear edge of the C- pillar.
- Do not mount equipment on the headliner along the saddleries.

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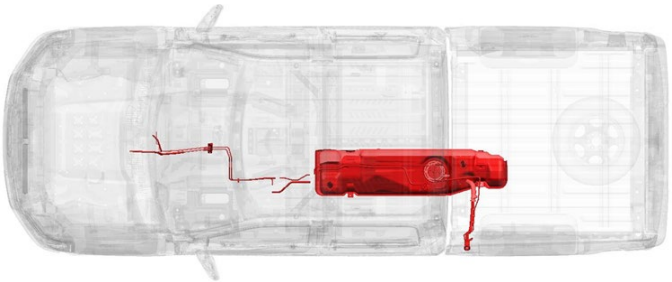
SECTION 5 - REFERENCE INFORMATION

FUEL SYSTEM



Top View Silhouette of Fuel System components

Fuel Pump (FP) Shut-Off Feature

In the event of a moderate to severe collision, the vehicle is equipped with a FP shut-off feature that is initiated by the event notification signal.

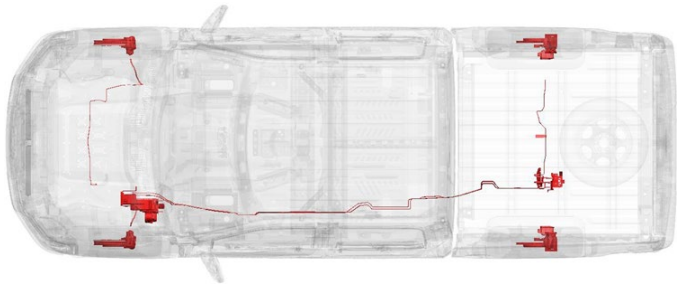
The event notification signal is a signal provided by the Restraints Control Module (RCM) to the FP control module. Signal communication between the RCM and the FP control module allows the PCM to shut off the FP.

Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances, the vehicle may not start the first time and may take one additional ignition cycle.

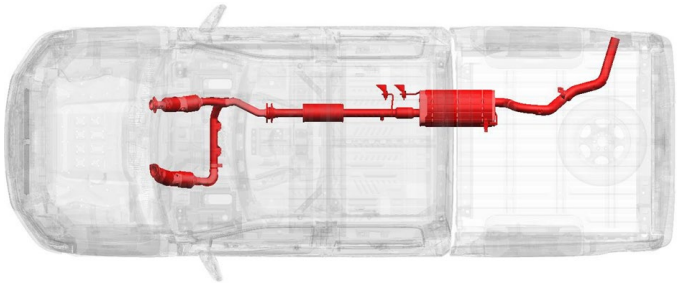
Brake System

Top View Silhouette of Brake System components

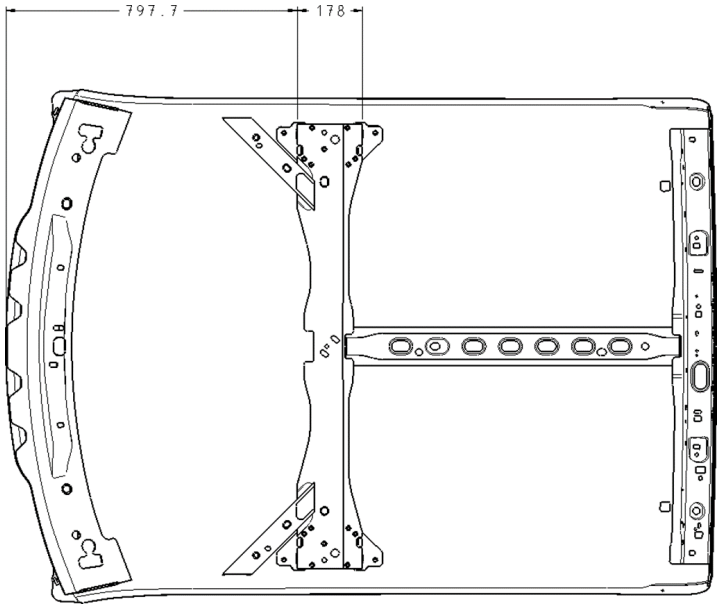
NOTICE: When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.



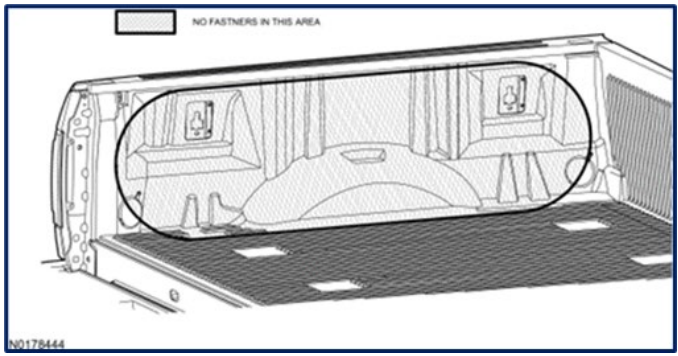
EXHAUST SYSTEM

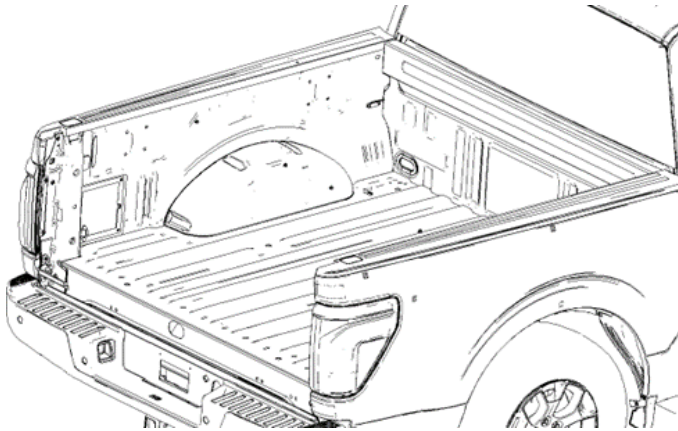


ROOF BOW HIGHLIGHTED FOR LIGHT BAR INSTALLATION



AREA IN BED TO AVOID





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SECTION 6 –CHANGE CONTROL

- 20250213 – Reformatted PMG Structure
- 20250207 - Published